DRAFT REPORT

Work Plan for A-12 Pit Surface Water Diversion

Gay Mine Site
Fort Hall Indian Reservation
Bingham County, Idaho

Submitted to:

US Environmental Protection Agency, US Bureau of Land Management, and Shoshone-Bannock Tribes

1200 Sixth Avenue, Suite 155 (12-D12-1)
Seattle, WA 98101

Submitted on Behalf of:
FMC Corporation, J.R. Simplot Company

Submitted by:

Golder Associates Inc.

18300 NE Union Hill Road, Suite 200
Redmond, Washington, USA 98052
+1 425 883-0777

103-93418-16.900

February 26, 2020

Distribution List

1 Copy	Kelly Wright, SBT
1 Copy	Susan Hanson, SBT
1 Copy	Dave Heineck, Summit Law Group
1 Copy	Jonathan Bucca, FMC
1 Copy	Preston Smith, BIA
2 Copies	Helen Bottcher, USEPA
1 Copy +cd	Colleen S. O'Hara, BLM

Electronic Only:
Marc Stifelman, USEPA
Ted Repasky, USEPA
Nick Vidargas, USEPA
Joe Goulet, USEPA
Kay Morrison, USEPA
Allan Erickson, Jacobs
Jeff Schut, Jacobs
Ryan Braham, USFWS
Jeremy Moore, USFWS
Dedra Williams, J.R. Simplot
Lori Lusty, J.R. Simplot
Jeff Hamilton, J.R. Simplot Company
Alan Prouty, J.R. Simplot Company

Table of Contents

1.0 INTRODUCTION 1

1.1 Purpose and Scope 1

1.2 Work Plan Organization 1

2.0 SITE BACKGROUND 2

2.1 Site Location and Description 2

2.2 Main Features of the A-12 Pit Area 2

2.3 Surface Water Characterization Activities 3

2.4 Survey of Potential Surface Water Diversion Alignments 3

3.0 SURFACE WATER DIVERSION OBJECTIVE 3

4.0 SURFACE WATER DIVERSION ALTERNATIVES 4

4.1 Alternative A – North Pipeline / Ditch 4

4.2 Alternative B – South Pipeline / Ditch 5

5.0 COST ESTIMATES 6

6.0 RECOMMENDED ALTERNATIVE 6

7.0 CLOSING 7

8.0 REFERENCES 8

TABLES

Table 1: Surface Water Sample Results

Table 2: Summary of Estimated Alternative Costs

Table 3: Cost Estimate for Alternative A - North Pipeline / Ditch

Table 4: Cost Estimate for Alternative B - South Pipeline / Ditch

FIGURES

Figure 1: Site Location Map

Figure 2: Site Layout

Figure 3: Surface Water Sample Locations

Figure 4: Alternative A – North Pipeline / Ditch Plan and Profile

Figure 5: Alternative B – South Pipeline / Ditch Plan and Profile

Figure 6: Extended Ditch Plan and Profile

Figure 7: Typical Sections

APPENDICES

APPENDIX A
Gay Mine A-12 Pit Area Photographs

APPENDIX B
Hydrology and Hydraulics Calculations

APPENDIX C
Cost Estimate Information

List of Acronyms

ASA	Administrative Settlement Agreement and Administrative Order on Consent
BIA	United States Bureau of Indian Affairs
BLM	United States Bureau of Land Management
bcy	bank cubic yards
the Companies	J.R. Simplot Company and FMC Corporation
CMP	corrugated metal pipe
DOI	United States Department of Interior
FMC	FMC Corporation
Golder	Golder Associates Inc.
HDPE	high density polyethylene
MSGP	Multi-Sector General Permit
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PPR	Project Planning Report
PSR	Project Scoping Report
RI/FS	Remedial Investigation / Feasibility Study
Simplot	J.R. Simplot Company
Site	Gay Mine Site
Tribes	Shoshone-Bannock Tribes
µg/L	micrograms per liter
USDA-NAIP	United States Department of Agriculture – National Agriculture Imagery Program
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

1.0 INTRODUCTION

This Work Plan has been prepared by Golder Associates Inc. (Golder) on behalf of the J.R. Simplot Company (Simplot) and FMC Corporation (FMC; collectively, "the Companies") to evaluate alternatives to divert surface water from the Upper Pond and prevent it from entering the A-12 Pit at the Gay Mine Site (the Site) in southeastern Idaho.

The Companies are conducting a Remedial Investigation / Feasibility Study (RI/FS) pursuant to the requirements of the Administrative Settlement Agreement and Order on Consent (ASA) for the Site. The ASA, with an effective date of December 10, 2010, was entered into voluntarily by the United States Environmental Protection Agency (USEPA), the Companies, and the Shoshone-Bannock Tribes (the Tribes). The United States Department of Interior (DOI) is a support agency for purposes of the ASA implementation, including its constituent agencies the United States Bureau of Land Management (BLM), the United States Bureau of Indian Affairs (BIA), and the United States Fish and Wildlife Service (USFWS). This Work Plan was not specifically identified in the ASA Statement of Work and is being voluntarily submitted by the Companies to evaluate alternatives for diverting surface water inflow to the A-12 Pit under the control measures selection criteria set forth at Section 2.1.1 of the USEPA National Pollutant Discharge Elimination System (NPDES) Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP).

1.1 Purpose and Scope

The purpose of this Work Plan is to evaluate alternatives to divert non-impacted surface water from the Upper Pond and prevent it from discharging to the A-12 Pit, where sample results have shown it becomes impacted with elevated levels of selenium and may potentially present a threat to livestock and wildlife.

To date, surface water sample results have indicated that non-impacted surface water discharging from the Upper Pond becomes impacted in Ponds 1 and 2 and the A-12 Pit (see Section 2.0). The Companies understand that the Tribes also have a strong interest in retaining the storage capacity of the Upper Pond for general uses such as fire suppression and livestock watering.

Surface water in the Upper Pond is fed by an upstream spring. The surface water diversion described in this Work Plan meets the criteria and objectives set forth at NPDES MSGP Section 2.1.1 for minimizing surface water contact with polluting materials at industrial sites.

1.2 Work Plan Organization

This Work Plan contains the following sections:

- Section 1.0 – Presents the purpose and scope of this Work Plan and describes the Work Plan organization
- Section 2.0 – Provides a summary of background information pertaining to surface water and the A-12 Pit
- Section 3.0 – Describes the objective of the surface water diversion
- Section 4.0 – Presents a description of the alternatives developed for the surface water diversion
- Section 5.0 – Provides a summary of the cost for each of the alternatives
- Section 6.0 – Describes the recommended alternative
- Section 7.0 – Closing
- Section 8.0 – Provides a list of references cited in the Work Plan

2.0 SITE BACKGROUND

Existing site background information pertaining to surface water and the A-12 Pit area of the Site is summarized in this section. Refer to the Project Scoping Report (PSR, Golder 2011), Project Planning Report (PPR, Golder 2012a), the RI Work Plan (Golder 2014), and annual RI Data Summary Reports for work performed from 2014 through 2018 (Golder 2015, 2016, 2017, 2018, and 2019) for more details and comprehensive information regarding the Site as a whole. The PSR provides a summary of the historical information and environmental data available for the Site through 2011. The PPR presents a preliminary conceptual site model for the Site based on existing information on known and suspected sources of contamination, types of contamination, affected media / resources, known and potential routes of migration, and known or potential human and environmental receptors. The RI Work Plan presents the approach for conducting the RI to obtain the data necessary to characterize the Site. Annual RI Data Summary Reports summarize field sampling activities performed in accordance with the RI Work Plan.

2.1 Site Location and Description

The Site is an inactive surface phosphate mine located in Bingham and Bannock Counties within the exterior boundary of the Fort Hall Indian Reservation. The Site is approximately 25 miles northeast of Pocatello, Idaho and 15 miles east of Fort Hall, Idaho (Figure 1) in portions of Townships 4 and 5 South, and Ranges 37 and 38 East of the Boise Meridian. The elevation of the Site ranges from about 5,400 to 6,200 feet above mean sea level.

The Site encompasses three geographically separate mining areas: the North Limb (which includes the Headquarters Area in the southern portion), East Limb, and the South 40 (Figure 1). The Headquarters Area was the location of maintenance and support facilities. In addition, ore stockpiling, staging, and rail car loading were conducted in this area. The A-12 Pit is in the southern portion of the North Limb, approximately 2,000 feet east of the Headquarters Area (Figure 2). The A-12 Pit area can be accessed from the west via Lone Pine Road through the Headquarters Area (Figure 2).

2.2 Main Features of the A-12 Pit Area

Mine pits in the A-12 Pit area include A-1 through A-12. Mill shale piles in the A-12 Pit area include A-2/A-3, A-5, A-6, A-7, and B-4C. Photographs taken of the A-12 Pit area during site visits conducted in May 2011 and August 2012, as well as during surface water sampling events conducted in Fall 2015, Spring 2016, Spring 2018 and Fall 2018 are included in Appendix A.

The A-12 Pit was mined from 1989 through 1992 and was the last in its series. The western portion of the A-12 Pit was backfilled with overburden from one of the pits excavated after A-12, but the eastern portion of the pit was not backfilled and currently contains a pit lake. The A-12 Pit is bounded by highwalls to the north, east, and south. Rill erosion is present in the north highwall due to surface water drainage and in the east highwall due to seeps (Photos 1 and 2, Appendix A). Seeps are also present along the south highwall, making it extremely wet and historically difficult to work during mining operations.

The main sources of water to the A-12 Pit are spring-fed ponds located upgradient. The Bunkhouse and Danielson Springs discharge from locations approximately 1.5 miles to the northeast of the A-12 Pit (Figure 2) and flow into the Upper Pond (also known as “the Reservoir”). The Upper Pond was constructed during mining operations. Overflow from the Upper Pond discharges to Pond 1 through a 24-inch corrugated metal pipe (CMP) beneath the road running east-west (Photo 5, Appendix A), and overflow from Pond 1 flows through a deep cut channel into Pond 2. Water from Pond 2 flows through a pipe beneath the road running north-south and then enters an open channel, subsequently pooling on a flat area above the A-12 Pit before flowing over the north highwall into the A-12 Pit (Photo 2, Appendix A).

2.3 Surface Water Characterization Activities

Environmental characterization activities have been conducted at the Site since approximately the expansion of mining activities into the South 40 Area in 1986. Environmental sampling has been performed for soil, vegetation, surface water, pit lake water, and other media. The PSR (Golder 2011) provides a detailed discussion of historical characterization activities conducted across the Site through 2011, and annual RI Data Summary Reports (Golder 2015, 2016, 2017, 2018, and 2019) summarize RI characterization activities performed from 2014 through 2018. Surface water samples were analyzed for selenium and other metals and general water quality parameters. Sample location descriptions and analytical results are summarized in Table 1. Surface water sample locations are shown in Figure 3.

The selenium concentrations have varied over time in the A-12 Pit and Pond 2 but have been consistently low in the Upper Pond and Pond 1. Detections of total selenium have ranged from 0.7 µg/L to 3.2 µg/L in the Upper Pond, 0.6 µg/L to 2.5 µg/L in Pond 1, 2.7 µg/L to 171 µg/L in Pond 2, and 1 µg/L to 638 µg/L in the A-12 Pit. In 2018, spring and fall samples had selenium concentrations about 3 micrograms per liter (µg/L) or less in the Upper Pond (SW-10), Pond #1 (SW-11), and Pond #2 (SW-12). The A-12 Pit (SW-13) had concentrations between 81 µg/L and 87 µg/L (Table 1).

2.4 Survey of Potential Surface Water Diversion Alignments

On August 2, 2012, Golder engineers walked and flagged points along two potential alignments (referred to as the North Alignment and the South Alignment, respectively) for diversion of surface water away from the A-12 Pit. Each alignment started at the Upper Pond and ended near the Headquarters Area to the west of the A-12 Pit. A&E Engineering, Inc. surveyed the flagged points along each field alignment. These surveyed points were entered into AutoCAD Civil 3D along with 2011 base topography (Golder 2012b) and an aerial photo (United States Department of Agriculture – National Agriculture Imagery Program [USDA-NAIP] 2009) for analysis in the Work Plan. Upon examination of the surveyed points in relation to the base topography and aerial photo, the alignments were modified slightly from those provided by A&E Engineering, Inc. to fit in with the Site features and terrain (e.g., connection with the existing ditch in the Headquarters Area). The North and South Alignments used for analysis in the Work Plan are shown in Figures 4 and 5, respectively. Photos were taken along the alignments during the August 2012 site visit (Photos 6 through 10, Appendix A).

3.0 SURFACE WATER DIVERSION OBJECTIVE

The objective of the surface water diversion is to divert non-impacted surface water from the Upper Pond and prevent it from discharging to the A-12 Pit. This section describes the background for determination of the surface water diversion objective.

To summarize the description of surface water drainage contributing to the A-12 Pit (described in detail in Section 2.2), surface water drains to the Upper Pond (also known as “the Reservoir”), discharges from the Upper Pond to Pond 1 through a culvert under the road, flows through a channel from Pond 1 to Pond 2, discharges from Pond 2 through a culvert under the road, and subsequently pools on a flat area above the A-12 Pit before flowing over the north highwall into the A-12 Pit. Surface water sample results (see Section 2.3) have shown that surface water in the Upper Pond has low concentrations of selenium, Ponds 1 and 2 contain slightly elevated levels of selenium, and surface water in the A-12 Pit contains selenium greater than general water quality guidelines.

In an attempt to address the concern of exposure of livestock and wildlife to A-12 Pit water that contains elevated levels of selenium, the surface water diversion will divert non-impacted water away from the A-12 Pit, thereby reducing the volume of water entering the A-12 Pit and decreasing the water level in the A-12 Pit.

In addition, since the Companies understand that the Tribes have a strong interest in retaining the storage capacity of the Upper Pond for general uses such as fire suppression and livestock watering, the surface water diversion will divert water downstream of the Upper Pond, rather than from a point further up the drainage.

4.0 SURFACE WATER DIVERSION ALTERNATIVES

An alternative was developed along each of the two surveyed alignments (the North Alignment and the South Alignment) using a combination of ditches and buried pipelines, depending on the existing terrain along the alignment. Under each alternative, the existing ditch would be improved and extended to discharge to the Dry Hollow Drainage. Each alternative is designed to convey the peak flow from the 25-year, 24-hour storm event.

4.1 Alternative A – North Pipeline / Ditch

Under this alternative, a 1.5-foot-diameter high density polyethylene (HDPE) pipeline would extend from the Upper Pond approximately 3,400 feet before discharging to a 1,200-foot long rock-lined ditch. The 1,200-foot long rock-lined ditch would then connect to the extended ditch which is common to both Alternatives A and B. For most of its length, the extended ditch includes an existing ditch in the Headquarters Area on the north side of the railroad, which would be upgraded to the required size from this location to the discharge point at Dry Hollow Drainage. Through the Headquarters Area, a 200-foot-long portion of the extended ditch would be lined with an HDPE lining system (or other suitable low permeability material) to ensure there was no infiltration of metals from soil near the tipple. The North Pipeline / Ditch alignment and profile are shown in Figure 4 and the alignment and profile for the extended ditch are shown in Figure 6. Typical sections of the ditches and pipeline trench are presented in Figure 7.

The pipeline and ditches were sized to convey the peak flow from the 25-year, 24-hour storm event with the Upper Pond used as a reservoir. Hydrologic modeling was performed in HEC-HMS Version 3.5 (United States Army Corps of Engineers [USACE] 2010) to determine the peak flow from the 25-year, 24-hour storm event, and the required pipe / ditch dimensions were determined with FlowMaster Version 8i (Bentley 2009). The drainage basin contributing to the Upper Pond was delineated in AutoCAD Civil 3D and was determined to be approximately 1,100 acres (Figure A, Appendix B). The Upper Pond was included in the HEC-HMS model as a reservoir with the pipeline as the reservoir outlet. From the topography, the top of the reservoir embankment was determined to be at approximately elevation 5,748 feet, and the pipeline inlet invert was set at elevation 5,740 feet. Using these parameters in addition to those presented in Appendix B, a 1.5-foot-diameter pipeline was determined to be the appropriate size to convey the peak flow from the 25-year, 24-hour storm event without exceeding a maximum peak elevation of 5,746 feet in the reservoir (embankment elevation minus 2 feet of freeboard). Using FlowMaster, a trapezoidal ditch with a 1.5-foot depth, 2-foot bottom width, and 2H:1V side slopes was determined to be adequate to convey the peak flow from the design storm event in the downgradient portion of the North Alignment. Hydrology and hydraulics calculations are presented in Appendix B.

The pipeline trench excavation was modeled in AutoCAD Civil 3D as a corridor along the North Alignment using the profile shown in Figure 4 and the typical section presented in Figure 7. In the trench, the pipeline would be underlain by a 3-inch minimum layer of bedding sand and overlain by a 6-inch minimum layer of bedding sand to prevent damage from rocky soil subgrade and backfill. The pipeline would be butt-welded adjacent to the trench and lowered into the trench by a crane. There would be a 1-foot minimum spacing on each side of the pipeline to allow for installation, resulting in a trench bottom width of 3.5 feet. Trench side slopes would be 1H:1V. The volume of excavation required for the 3,400-foot long trench was determined to be approximately 16,700 bank cubic yards (bcy). Excavated soil would be stockpiled temporarily along the length of the pipeline and used as backfill following installation of the pipeline. Excess backfill material would be mounded above and placed adjacent to the pipeline, then graded to drain and blend with existing topography.

The pipeline would daylight at approximately STA 33+85 and transition to the rock-lined ditch. Riprap would be placed for outlet protection at the pipeline discharge location. The rock-lined ditch would consist of a compacted native soil subgrade, overlain by geotextile, and overlain by a 6-inch-thick layer of 3-inch rock (average diameter size). The volume of excavation required for the 1,200-foot long rock-lined ditch would be approximately 540 bcy, and the volume of excavation required for the extended ditch would be approximately 1,730 bcy. Excavated soil would be placed adjacent to the ditch and graded to drain and blend with existing topography. The rock-lined ditch would transition to the 200-foot long portion lined with a HDPE ditch lining system (or other suitable low permeability material) in the Headquarters Area. A rock-lined broad swale would be constructed across the access road to the North Limb area at approximately STA 40+00 (Extended Ditch Alignment, Figure 6). Minimal maintenance would be required for a broad swale as compared to a culvert.

Also, under Alternative A, the existing 24-inch CMP outlet from the Upper Pond to Pond 1 would be plugged, and disturbed areas would be hydroseeded following construction. Operation and Maintenance (O&M) would include:

- Annual inspection of the pipeline inlet, ditch, and other features before the winter snow begins
- Removing and disposing of any debris accumulation
- Maintenance and repair of erosion areas observed along the ditch during annual inspections
- Annual monitoring of A-12 Pit conditions, such as water level, any seeps, or surface water discharges to the pit

4.2 Alternative B – South Pipeline / Ditch

This alternative is similar in overall concept to Alternative A, the main difference is that the ditch / pipeline would run along a different alignment. Under Alternative B, a 1.5-foot diameter HDPE pipeline would extend approximately 1,500 feet before discharging to a 2,300-foot long rock-lined ditch. The 2,300-foot long rock-lined ditch would then connect to the extended ditch which is common to both Alternatives A and B. For most of its length, the extended ditch includes an existing ditch in the Headquarters Area on the north side of the railroad, which would be upgraded to the required size from this location to the discharge point at Dry Hollow Drainage. Similar to Alternative A, through the Headquarters Area, a 200-foot long portion of the extended ditch would be lined with a HDPE ditch lining system (or other suitable low permeability material). The South Ditch / Pipeline alignment and profile are shown in Figure 5, and the alignment and profile for the extended ditch are shown in Figure 6. Typical sections of the ditches and pipeline trench are presented in Figure 7.

The pipeline and ditches were sized using the same methodology as described for Alternative A (Section 4.1). Similarly, a 1.5-foot diameter pipeline was determined to be the appropriate pipeline size to convey the peak flow from the 25-year, 24-hour storm event without exceeding a maximum water surface elevation of 5,746 feet in the Upper Pond reservoir. However, because of the lower gradient along the lined ditch, a slightly larger ditch with a 2-foot depth (rather than a 1.5-foot depth) would be required. In addition, because the pipeline is steeper in this alternative, a slightly more substantial energy dissipation structure (i.e., additional riprap) would be required at the pipeline discharge due to the greater discharge velocity.

The pipeline would be installed with the same trench excavation configuration and method as described for Alternative A, but along the profile shown in Figure 5. Under Alternative B, the volume of excavation required for the 1,500-foot long trench was determined in AutoCAD Civil 3D to be approximately 19,500 bcy. The pipeline would daylight at approximately STA 14+93 and transition to the rock-lined ditch. The rock-lined ditch would transition to the 200-foot long portion lined with a HDPE ditch lining system (or other suitable low permeability material) in the Headquarters Area. Under Alternative B, the volume of excavation required for the 2,300-foot long ditch would be approximately 730 bcy.

Similar to Alternative A, under Alternative B the existing 24-inch CMP outlet from the Upper Pond to Pond 1 would be plugged, and disturbed areas would be hydroseeded following construction.

O&M activities for Alternative B would be the same as those described for Alternative A.

5.0 COST ESTIMATES

Construction cost estimates have been prepared for each alternative based on the descriptions and associated assumptions presented in Section 4.0. A summary of the estimated alternative costs is presented in Table 2. Cost estimate breakdowns for Alternatives A and B are presented in Tables 3 and 4, respectively. Quantities, unit costs, assumptions, and factors used in the cost estimates are included in Appendix C.

For Alternative A (North Ditch / Pipeline) and Alternative B (South Pipeline / Ditch), the total costs are $771,000 and $609,000, respectively, which is a 21% difference (with Alternative B being more cost-effective).

6.0 RECOMMENDED ALTERNATIVE

Considering the overall cost, Alternative B (South Pipeline / Ditch) is the recommended alternative. Both alternatives will be effective at diverting the water and both are implementable. The factors that favor Alternative B are: 1) Alternative B is about 21% less expensive than Alternative A, and 2) while both Alternatives A and B meet the 25-year, 24-hour design storm requirement, Alternative B could also store and convey flows up through the 50-year, 24-hour storm event without overtopping the Upper Pond embankment.

7.0 CLOSING

We appreciate the opportunity to support FMC Corporation and J.R. Simplot Company on this project and trust that this analysis meets your present requirements. If you have any questions or require additional information, please contact the undersigned.

Golder Associates Inc.

DRAFT **DRAFT**

Jeremy Clark
Senior Project Environmental Toxicologist

Vanessa M. Nancarrow, PE
Senior Project Civil Engineer

JC/VMN/FSS/DGS/sb

(b) (6)

8.0 REFERENCES

Bentley Systems, Inc. (Bentley). 2009. Bentley FlowMaster, Version 8i. November 4.

Golder Associates Inc. (Golder). 2011. Project Scoping Report, Gay Mine RI/FS, Fort Hall Indian Reservation, Fort Hall, Idaho, prepared for FMC Corporation and J.R. Simplot Company. Project No. 103-93418-001.127. August 31.

Golder. 2012a. Draft Project Planning Report, Gay Mine RI/FS, Fort Hall Indian Reservation, Fort Hall, Idaho, prepared for FMC Corporation and J.R. Simplot Company. October 5.

Golder. 2012b. Gay Mine Topography, created by Golder GIS Group from satellite imagery dated June 2, 2011. November 29.

Golder. 2014. Gay Mine Remedial Investigation Work Plan. Prepared for FMC Corporation and J.R. Simplot Company.

Golder. 2015. 2014 Gay Mine Remedial Investigation Data Summary Report. Prepared for FMC Corporation and J.R. Simplot Company. April 22.

Golder. 2016. 2015 Gay Mine Remedial Investigation Data Summary Report. Prepared for FMC Corporation and J.R. Simplot Company. October 11.

Golder. 2017. 2016 Gay Mine Remedial Investigation Data Summary Report. Prepared for FMC Corporation and J.R. Simplot Company. July 7.

Golder. 2018. 2017 Gay Mine Remedial Investigation Data Summary Report. Prepared for FMC Corporation and J.R. Simplot Company. January 10.

Golder. 2019. Draft 2018 Gay Mine Remedial Investigation Data Summary Report. Prepared for FMC Corporation and J.R. Simplot Company. February 25.

Montgomery Watson Harza (MWH). 1998. Fall 1997 Interim Surface Water Survey Report. Southeast Idaho Phosphate Resource Area Selenium Project. Idaho Mining Association, Selenium Subcommittee. February.

MWH. 2002. Final Summer 2001 Area-Wide Investigation Data Summary. Idaho Mining Association, Selenium Subcommittee. July.

Parametrix. 2004. Surface water quality monitoring at the Gay Mine: Spring 2004, prepared for J.R. Simplot Company and FMC Corporation. July.

Shoshone-Bannock Tribes (SBT). 2008. Surface Water Sampling Results from June 2008, Intermountain Analytical Services-EnviroChem. July 8.

SBT. 2009a. Surface Water Sampling Results from April 2009, Intermountain Analytical Services-EnviroChem. May 15.

SBT. 2009b. Gay Mine Selenium Hot Spot Investigation Report. Prepared by the Environmental Waste Management Division. November 30.

United States Army Corps of Engineers (USACE). 2010. Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS), Version 3.5. August.

United States Department of Agriculture – National Agriculture Imagery Program (USDA-NAIP). 2009. Aerial Imagery for Bingham, Bannock, and Caribou Counties, Idaho.

Tables

Table 1: Surface Water Sample Results

					Analytes (µg/l)												
Sample ID / Location Code	Location Description	Source	Sample Date	Fraction (Total, Dissolved)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Chromium (III)	Hexavalent Chromium	Cobalt
SW-010	Main Holding Pond above A12 Pit	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	< 10	--	< 6.0	--	--	--
SW-010	Main Holding Pond above A12 Pit	Parametrix 2004	4/6/2004	T	--	--	--	--	--	--	--	--	162000	--	--	--	--
MHP061208	Main Holding Pond above A12 Pit	SBT 2008	6/12/2008	D	<10	<1.0	1.0	--	<1.0	--	--	<1.0	--	<1.0	--	--	--
MHP061208	Main Holding Pond above A12 Pit	SBT 2008	6/12/2008	T	<10	<1.0	2.0	53	--	<1.0	--	<1.0	139000	<1.0	--	--	--
GM2009-04	Main Holding Pond	SBT 2009a	4/27/2009	D	--	1.0	1.0	--	<1.0	--	--	<1.0	--	<1.0	--	--	--
GM2009-04	Main Holding Pond	SBT 2009a	4/27/2009	T	20	<1.0	2.0	67	--	<1.0	--	<1.0	130800	<1.0	--	--	--
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2016	9/1/2015	D	< 3.0	0.75	2.74	158	< 0.50	--	148	< 0.007	149000	< 0.9	< 0.9	0.252	< 2.0
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2016	9/1/2015	T	784	0.71	3.02	175	< 0.50	--	127	0.258	155000	2.5	2.2	0.252	< 2.0
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2017	5/18/2016	D	< 4.0	1.08	0.62	98.8	< 0.20	--	116	0.008	148000	< 0.6	< 0.6	0.128	1
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2017	5/18/2016	T	24.1	0.532	0.633	100	< 0.20	--	117	0.018	150000	< 0.6	< 0.6	0.088	< 0.5
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	5/21/2018	D	15	0.329	0.688	61.4	< 0.5	--	74.9	0.02	131000	< 0.9	1.1	0.032	0.183
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	5/21/2018	T	22	0.306	0.764	63.1	< 0.5	--	74.6	0.021	127000	< 0.9	< 0.9	0.036	0.183
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	9/18/2018	D	< 4	0.453	0.748	72.7	< 0.2	--	114	< 0.008	76200	< 0.6	< 0.6	< 0.010	0.343
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	9/18/2018	T	158	0.410	0.772	75.8	< 0.2	--	115	0.025	76000	< 0.6	< 0.6	< 0.010	0.267
SP036	Gay Mine Pond #1 above A-12 Pit	MWH 1998	9/23/1997	NR	--	--	--	--	--	--	--	--	--	--	--	--	--
SP036	Gay Mine Pond #1 above A-12 Pit	MWH 2002	5/16/2001	NR	34	< 2.5	3.3	110	< 5.0	--	94	< 0.7	140000	< 8.0	--	--	--
SW-011	Pond 1 above A12 Pit (East)	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	< 0.1	--	< 6.0	--	--	--
SW-011	Pond 1 above A12 Pit (East)	Parametrix 2004	4/6/2004	T	--	--	--	--	--	--	--	--	128000	--	--	--	--
SW-011	Pond 1 above A12 Pit (East)	Golder 2016	9/1/2015	D	< 3.0	1.00	2.36	210	< 0.50	--	178	< 0.007	202000	1.1	0.886	0.214	< 2.0

Table 1: Surface Water Sample Results

					Analytes (µg/l)												
Sample ID / Location Code	**Location Description**	**Source**	**Sample Date**	**Fraction (Total, Dissolved)**	**Aluminum**	**Antimony**	**Arsenic**	**Barium**	**Beryllium**	**Bismuth**	**Boron**	**Cadmium**	**Calcium**	**Chromium**	**Chromium (III)**	**Hexavalent Chromium**	**Cobalt**
SW-011	Pond 1 above A12 Pit (East)	Golder 2016	9/1/2015	T	364	0.56	2.59	204	< 0.50	--	165	0.095	206000	< 0.9	< 0.9	0.024	< 2.0
SW-011	Pond 1 above A12 Pit (East)	Golder 2017	5/18/2016	D	< 4.0	0.473	0.819	91.8	< 0.20	--	191	0.009	196000	< 0.6	< 0.6	0.058	< 0.5
SW-011	Pond 1 above A12 Pit (East)	Golder 2017	5/18/2016	T	33.1	0.344	1.23	94	< 0.20	--	191	0.024	198000	1.1	1	0.049	< 0.5
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	5/21/2018	D	7	0.23	0.743	51.3	< 0.5	--	75	0.019	120000	< 0.9	< 0.9	0.034	0.159
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	5/21/2018	T	26	0.229	0.896	54.3	< 0.5	--	76.8	0.029	121000	< 0.9	< 0.9	0.041	0.161
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	9/18/2018	D	< 4	0.257	1.30	59.2	< 0.2	--	117	< 0.008	67300	< 0.6	< 0.6	< 0.02	0.194
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	9/18/2018	T	28	0.230	1.28	58.6	< 0.2	--	109	0.027	66200	< 0.6	< 0.6	< 0.010	0.147
SP037	Gay Mine Pond #2 above A-12 Pit	MWH 1998	9/23/1997	NR	--	--	--	--	--	--	--	--	--	--	--	--	--
SP037	Gay Mine Pond #2 above A-12 Pit	MWH 2002	5/16/2001	NR	--	--	--	--	--	--	--	--	--	--	--	--	--
SP037	Gay Mine Pond #2 above A-12 Pit	MWH 2002	5/16/2001	NR	34	< 2.5	2.6	120	< 5.0	--	72	< 0.7	140000	< 8.0	--	--	--
SW-012	Pond 2 above A12 Pit (West)	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	0.3	--	< 6.0	--	--	--
SW-012	Pond 2 above A12 Pit (West)	Parametrix 2004	4/6/2004	T	--	--	--	--	--	--	--	--	101000	--	--	--	--
SW-012	Pond 2 above A12 Pit (West)	Golder 2017	5/18/2016	D	11.8	2.6	4.49	69	< 0.20	--	95.6	0.363	151000	0.7	< 0.6	0.148	1.3
SW-012	Pond 2 above A12 Pit (West)	Golder 2017	5/18/2016	T	164	2.07	5.6	75.7	< 0.20	--	95.3	0.912	153000	2.7	2.6	0.125	0.5
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	5/21/2018	D	33	0.287	0.72	47.3	< 0.5	--	76.4	0.096	122000	< 0.9	1.1	0.036	0.158
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	5/21/2018	T	40	0.238	0.835	49.9	< 0.5	--	77.1	0.107	121000	< 0.9	< 0.9	0.04	0.177
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	9/18/2018	D	< 4	0.997	4.28	188	< 0.2	--	181	0.024	101000	< 0.6	< 0.6	0.044	0.445
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	9/18/2018	T	297	0.924	4.34	207	< 0.2	--	186	0.698	107000	3.7	3.7	0.036	0.483
SP038	Gay Mine A-12 Lake in A-12 Pit	MWH 1998	9/23/1997	NR	--	--	--	--	--	--	--	--	--	--	--	--	--
SP038	Gay Mine A-12 Lake in A-12 Pit	MWH 2002	5/16/2001	NR	34	< 2.5	2.3	73	< 5.0	--	63	< 0.7	140000	< 8.0	--	--	--
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	< 0.1	--	< 6.0	--	--	--
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	T	--	--	--	--	--	--	--	--	149000	--	--	--	--
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	< 0.1	--	< 6.0	--	--	--

Table 1: Surface Water Sample Results

					Analytes (µg/l)												
Sample ID / Location Code	**Location Description**	**Source**	**Sample Date**	**Fraction (Total, Dissolved)**	**Aluminum**	**Antimony**	**Arsenic**	**Barium**	**Beryllium**	**Bismuth**	**Boron**	**Cadmium**	**Calcium**	**Chromium**	**Chromium (III)**	**Hexavalent Chromium**	**Cobalt**
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	T	--	--	--	--	--	--	--	--	154000	--	--	--	--
A12061208[1]	A12 Lake in A12 Pit	SBT 2008	6/12/2008	D	<10	<1.0	2.0	--	<1.0	--	--	<1.0	--	<1.0	--	--	--
A12061208[1]	A12 Lake in A12 Pit	SBT 2008	6/12/2008	T	<10	<1.0	<1.0	18	--	<1.0	--	<1.0	156700	<1.0	--	--	--
A12061308[1]	A12 Lake in A12 Pit	SBT 2008	6/13/2008	D	<10	<1.0	<1.0	--	<1.0	--	--	<1.0	--	<1.0	--	--	--
A12061308[1]	A12 Lake in A12 Pit	SBT 2008	6/13/2008	T	<10	<1.0	2.0	25	--	<1.0	--	<1.0	102400	<1.0	--	--	--
GM2009-05	A-12 Pit	SBT 2009a	4/28/2009	D	--	1.0	2.0	--	<1.0	--	--	<1.0	--	<1.0	--	--	--
GM2009-05	A-12 Pit	SBT 2009a	4/28/2009	T	170	<1.0	1.0	69	--	<1.0	--	<1.0	118600	1.0	--	--	--
SW-013	A12 Lake in A12 Pit	Golder 2016	9/1/2015	D	< 3.0	1.13	1.64	201	< 0.50	--	78.7	< 0.007	118000	< 0.9	< 0.9	0.099	< 2.0
SW-013	A12 Lake in A12 Pit	Golder 2016	9/1/2015	T	1020	0.97	2.16	209	< 0.50	--	148	< 0.007	118000	3.2	2.9	0.254	< 2.0
SW-013	A12 Lake in A12 Pit	Golder 2017	5/18/2016	D	< 3.0	0.792	0.468	55.4	< 0.50	--	50.6	0.05	148000	< 0.9	< 0.9	0.221	< 0.5
SW-013	A12 Lake in A12 Pit	Golder 2017	5/18/2016	T	14.1	0.725	0.509	55.9	< 0.50	--	52	0.07	148000	1.3	1.1	0.209	< 0.5
SW-013	A12 Lake in A12 Pit	Golder 2019	5/21/2018	D	9	0.433	1.07	64.6	< 0.5	--	75	1.74	137000	< 0.9	< 0.9	0.915	0.097
SW-013	A12 Lake in A12 Pit	Golder 2019	5/21/2018	T	11	0.428	1.01	65.4	< 0.5	--	73.8	1.75	129000	< 0.9	< 0.9	0.909	0.093
SW-013	A12 Lake in A12 Pit	Golder 2019	9/19/2018	D	< 4	0.510	1.48	60.4	< 0.2	--	150	0.041	104000	< 0.6	< 0.6	0.728	0.113
SW-013	A12 Lake in A12 Pit	Golder 2019	9/19/2018	T	30	0.513	1.35	61.4	< 0.2	--	90	0.064	104000	< 0.6	< 0.6	0.754	0.082

Table 1: Surface Water Sample Results

					Analytes (µg/l)												
Sample ID / Location Code	**Location Description**	**Source**	**Sample Date**	**Fraction (Total, Dissolved)**	**Copper**	**Fluoride**	**Iron**	**Lead**	**Magnesium**	**Manganese**	**Mercury**	**Molybdenum**	**Neodymium**	**Nickel**	**Palladium**	**Phosphorus**	**Potassium**
SW-010	Main Holding Pond above A12 Pit	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	< 10	--	--	--
SW-010	Main Holding Pond above A12 Pit	Parametrix 2004	4/6/2004	T	--	--	--	--	91800	--	--	--	--	--	--	--	--
MHP061208	Main Holding Pond above A12 Pit	SBT 2008	6/12/2008	D	<1.0	--	--	<1.0	--	--	<1.0	--	--	1.0	--	--	--
MHP061208	Main Holding Pond above A12 Pit	SBT 2008	6/12/2008	T	<1.0	--	30	<1.0	62430	10	<1.0	--	<1.0	2.0	<1.0	--	5810
GM2009-04	Main Holding Pond	SBT 2009a	4/27/2009	D	<1.0	--	--	<1.0	--	--	<1.0	--	--	2.0	--	--	--
GM2009-04	Main Holding Pond	SBT 2009a	4/27/2009	T	1.0	--	26	<1.0	55320	300	<1.0	--	<1.0	2.0	<1.0	--	6320
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2016	9/1/2015	D	< 2.0	--	8.0	0.017	104000	88.7	0.67	20.6	--	3.3	--	100	13300
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2016	9/1/2015	T	< 2.1	--	1120	0.717	109000	209	2.84	22.8	--	6.1	--	495	14300
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2017	5/18/2016	D	< 0.9	--	3.8	< 0.004	97700	44.8	< 0.02	15.8	--	4.8	--	39.2	11200
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2017	5/18/2016	T	< 0.9	--	47.7	0.048	98600	55.7	< 0.02	18.7	--	4.8	--	58.9	111000
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	5/21/2018	D	< 2.1	--	33	0.036	38700	231	< 0.02	8.5	--	< 0.9	--	58	2080
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	5/21/2018	T	< 2.1	--	48	0.04	40200	228	< 0.02	8.4	--	< 0.9	--	63	2220
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	9/18/2018	D	< 0.9	--	13	0.041	49600	81.6	< 0.02	6.2	--	0.7	--	< 42	2680
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	9/18/2018	T	< 0.9	--	186	0.189	49000	94.3	< 0.02	6.0	--	0.8	--	57	2650
SP036	Gay Mine Pond #1 above A-12 Pit	MWH 1998	9/23/1997	NR	--	--	--	--	--	--	--	--	--	--	--	--	--
SP036	Gay Mine Pond #1 above A-12 Pit	MWH 2002	5/16/2001	NR	1.4	440	21	< 2.7	74000	1200	< 0.5	5.0	--	< 3.3	--	< 950	< 9500
SW-011	Pond 1 above A12 Pit (East)	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	< 10	--	--	--
SW-011	Pond 1 above A12 Pit (East)	Parametrix 2004	4/6/2004	T	--	--	--	--	68800	--	--	--	--	--	--	--	--
SW-011	Pond 1 above A12 Pit (East)	Golder 2016	9/1/2015	D	< 2.0	--	6.2	0.024	166000	579	0.91	24.6	--	2.1	--	105	14800

Table 1: Surface Water Sample Results

Sample ID / Location Code	Location Description	Source	Sample Date	Fraction (Total, Dissolved)	Analytes (µg/l) Copper	Fluoride	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Neodymium	Nickel	Palladium	Phosphorus	Potassium
SW-011	Pond 1 above A12 Pit (East)	Golder 2016	9/1/2015	T	< 2.0	--	483	0.308	174000	599	2.43	7.8	--	3.3	--	256	15600
SW-011	Pond 1 above A12 Pit (East)	Golder 2017	5/18/2016	D	< 0.9	--	36.4	< 0.004	144000	940	< 0.02	16.3	--	4.1	--	37.3	13300
SW-011	Pond 1 above A12 Pit (East)	Golder 2017	5/18/2016	T	< 0.9	--	381	0.084	143000	965	< 0.02	25.5	--	4.8	--	86.8	13300
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	5/21/2018	D	< 2.1	--	50	< 0.004	42500	244	< 0.02	5.8	--	< 0.9	--	67	2210
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	5/21/2018	T	< 2.1	--	70	0.04	43100	277	< 0.02	5.6	--	< 0.9	--	68	2310
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	9/18/2018	D	< 0.9	--	11	< 0.04	58600	14.3	< 0.02	4.7	--	0.4	--	< 42	1690
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	9/18/2018	T	< 0.9	--	57	0.055	56300	26.6	< 0.02	4.8	--	0.7	--	48	1660
SP037	Gay Mine Pond #2 above A-12 Pit	MWH 1998	9/23/1997	NR	--	--	--	--	--	--	--	--	--	--	--	--	--
SP037	Gay Mine Pond #2 above A-12 Pit	MWH 2002	5/16/2001	NR	--	--	--	--	--	--	--	--	--	--	--	--	--
SP037	Gay Mine Pond #2 above A-12 Pit	MWH 2002	5/16/2001	NR	1.5	380	23	< 2.7	69000	490	< 0.5	5.5	--	< 3.3	--	< 950	< 9500
SW-012	Pond 2 above A12 Pit (West)	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	< 10	--	--	--
SW-012	Pond 2 above A12 Pit (West)	Parametrix 2004	4/6/2004	T	--	--	--	--	25200	--	--	--	--	--	--	--	--
SW-012	Pond 2 above A12 Pit (West)	Golder 2017	5/18/2016	D	7.3	--	26.6	0.041	55300	162	< 0.02	90.4	--	21.9	--	201	19800
SW-012	Pond 2 above A12 Pit (West)	Golder 2017	5/18/2016	T	9	--	359	0.289	55500	188	< 0.02	90.5	--	22.8	--	342	19700
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	5/21/2018	D	< 2.1	--	91	0.052	41500	142	< 0.02	5.8	--	< 0.9	--	89	2190
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	5/21/2018	T	< 2.1	--	100	0.055	43000	144	< 0.02	5.9	--	1.8	--	86	2230
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	9/18/2018	D	< 0.9	--	63	< 0.04	76200	1010	< 0.02	15.0	--	11.2	--	328	16600
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	9/18/2018	T	< 0.9	--	845	0.412	78200	1080	< 0.02	20.8	--	13.7	--	751	17100
SP038	Gay Mine A-12 Lake in A-12 Pit	MWH 1998	9/23/1997	NR	--	--	--	--	--	--	--	--	--	--	--	--	--
SP038	Gay Mine A-12 Lake in A-12 Pit	MWH 2002	5/16/2001	NR	1.8	650	< 10	< 2.7	69000	< 2.0	< 0.5	29	--	9.8	--	< 950	< 9500
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	13	--	--	--
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	T	--	--	--	--	60600	--	--	--	--	--	--	--	--
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	14	--	--	--

Table 1: Surface Water Sample Results

					Analytes (µg/l)												
Sample ID / Location Code	Location Description	Source	Sample Date	Fraction (Total, Dissolved)	Copper	Fluoride	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Neodymium	Nickel	Palladium	Phosphorus	Potassium
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	T	--	--	--	--	62000	--	--	--	--	--	--	--	--
A12061208[1]	A12 Lake in A12 Pit	SBT 2008	6/12/2008	D	<1.0	--	--	<1.0	--	--	<1.0	--	--	2.0	--	--	--
A12061208[1]	A12 Lake in A12 Pit	SBT 2008	6/12/2008	T	<1.0	--	20	<1.0	30230	3	<1.0	--	<1.0	<1.0	<1.0	--	2400
A12061308[1]	A12 Lake in A12 Pit	SBT 2008	6/13/2008	D	<1.0	--	--	<1.0	--	--	<1.0	--	--	<1.0	--	--	--
A12061308[1]	A12 Lake in A12 Pit	SBT 2008	6/13/2008	T	<1.0	--	20	<1.0	54620	29	<1.0	--	<1.0	3.0	<1.0	--	3300
GM2009-05	A-12 Pit	SBT 2009a	4/28/2009	D	<1.0	--	--	<1.0	--	--	<1.0	--	--	8.0	--	--	--
GM2009-05	A-12 Pit	SBT 2009a	4/28/2009	T	2.0	--	25	<1.0	47500	101	<1.0	--	<1.0	9.0	<1.0	--	4160
SW-013	A12 Lake in A12 Pit	Golder 2016	9/1/2015	D	< 2.0	--	6.3	0.017	76000	438	0.92	47.4	--	6.3	--	14.7	5430
SW-013	A12 Lake in A12 Pit	Golder 2016	9/1/2015	T	< 2.0	--	1230	0.822	76600	487	5.19	44.4	--	9.5	--	177	5620
SW-013	A12 Lake in A12 Pit	Golder 2017	5/18/2016	D	2	--	9.8	< 0.004	77200	151	< 0.02	41.7	--	6.9	--	11.9	5550
SW-013	A12 Lake in A12 Pit	Golder 2017	5/18/2016	T	2.6	--	42.9	0.038	77100	161	< 0.02	41.7	--	7	--	17.9	5480
SW-013	A12 Lake in A12 Pit	Golder 2019	5/21/2018	D	< 2.1	--	< 3	< 0.004	43800	13.5	< 0.02	23.6	--	16.8	--	< 6	2480
SW-013	A12 Lake in A12 Pit	Golder 2019	5/21/2018	T	< 2.1	--	21	< 0.004	47800	12.6	< 0.02	23	--	15.8	--	< 6	2750
SW-013	A12 Lake in A12 Pit	Golder 2019	9/19/2018	D	< 0.9	--	4	< 0.006	51800	4.7	< 0.02	24.5	--	8.5	--	< 42	2710
SW-013	A12 Lake in A12 Pit	Golder 2019	9/19/2018	T	< 0.9	--	33	< 0.04	51600	18.3	< 0.02	24.9	--	8.8	--	< 42	2710

Table 1: Surface Water Sample Results

					Analytes (µg/l)												
Sample ID / Location Code	Location Description	Source	Sample Date	Fraction (Total, Dissolved)	Selenium	Silicon	Silver	Sodium	Strontium	Tellurium	Thallium	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
SW-010	Main Holding Pond above A12 Pit	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	< 5.0	--	< 5.0	--
SW-010	Main Holding Pond above A12 Pit	Parametrix 2004	4/6/2004	T	< 3.0	--	--	--	--	--	--	--	--	< 5.0	--	--	--
MHP061208	Main Holding Pond above A12 Pit	SBT 2008	6/12/2008	D	--	--	<1.0	--	--	--	<1.0	--	--	--	--	<30	--
MHP061208	Main Holding Pond above A12 Pit	SBT 2008	6/12/2008	T	<1.0	1970	<1.0	--	446	<1.0	<1.0	<1.0	<0.01	--	<1.0	<30	<1.0
GM2009-04	Main Holding Pond	SBT 2009a	4/27/2009	D	--	--	<1.0	--	--	--	<1.0	--	--	--	--	18	--
GM2009-04	Main Holding Pond	SBT 2009a	4/27/2009	T	1	4190	<1.0	--	428	<1.0	<1.0	<1.0	2.0	--	<1.0	14	--
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2016	9/1/2015	D	1.1	--	< 0.002	158000	--	--	< 0.008	--	2.330	7.7	--	< 6.0	--
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2016	9/1/2015	T	1.2	--	0.016	158000	--	--	0.009	--	3.810	12.7	--	14.8	--
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2017	5/18/2016	D	2.6	--	< 0.003	131000	--	--	< 0.002	--	4.43	< 0.5	--	2.1	--
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2017	5/18/2016	T	2.3	--	< 0.003	131000	--	--	< 0.002	--	4.38	< 0.5	--	2.9	--
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	5/21/2018	D	3.3	--	< 0.008	64100	--	--	< 0.008	--	4.25	< 1.1	--	0.7	--
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	5/21/2018	T	3.2	--	< 0.008	67100	--	--	< 0.008	--	4.26	< 1.1	--	1.6	--
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	9/18/2018	D	0.6	--	< 0.02	86500	--	--	< 0.02	--	2.43	3.7	--	< 4.2	--
SW-010	Pond #3 / Main Holding Pond above A12 Pit	Golder 2019	9/18/2018	T	0.7	--	< 0.009	84900	--	--	< 0.009	--	2.42	4.0	--	< 4.2	--
SP036	Gay Mine Pond #1 above A-12 Pit	MWH 1998	9/23/1997	NR	0.951	--	--	--	--	--	--	--	--	--	--	--	--
SP036	Gay Mine Pond #1 above A-12 Pit	MWH 2002	5/16/2001	NR	1.3	--	< 2.1	100000	--	--	< 2.5	--	< 8.0	9.5	--	< 10	--
SW-011	Pond 1 above A12 Pit (East)	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	< 5.0	--	< 5.0	--
SW-011	Pond 1 above A12 Pit (East)	Parametrix 2004	4/6/2004	T	< 3.0	--	--	--	--	--	--	--	--	< 5.0	--	--	--
SW-011	Pond 1 above A12 Pit (East)	Golder 2016	9/1/2015	D	1	--	< 0.002	246000	--	--	< 0.008	--	1.430	3.7	--	1.7	--

Table 1: Surface Water Sample Results

					Analytes (µg/l)													
Sample ID / Location Code	Location Description	Source	Sample Date	Fraction (Total, Dissolved)	Selenium	Silicon	Silver	Sodium	Strontium	Tellurium	Thallium	Titanium	Uranium	Vanadium	Yttrium	Zinc	Zirconium
SW-011	Pond 1 above A12 Pit (East)	Golder 2016	9/1/2015	T	0.9	--	0.009	248000	--	--	< 0.008	--	1.220	4.1	--	5.6	--
SW-011	Pond 1 above A12 Pit (East)	Golder 2017	5/18/2016	D	2.2	--	< 0.003	169000	--	--	< 0.002	--	5.04	< 0.5	--	1.9	--
SW-011	Pond 1 above A12 Pit (East)	Golder 2017	5/18/2016	T	2.3	--	< 0.003	167000	--	--	< 0.002	--	5	< 0.5	--	2.6	--
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	5/21/2018	D	2.4	--	< 0.008	67000	--	--	< 0.008	--	3.85	< 1.1	--	1.2	--
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	5/21/2018	T	2.5	--	< 0.008	68600	--	--	0.01	--	3.96	< 1.1	--	1.3	--
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	9/18/2018	D	0.6	J	< 0.009	88300	--	--	< 0.009	--	1.27	2.5	--	< 4.2	--
SW-011	Pond 1 above A12 Pit (East)	Golder 2019	9/18/2018	T	0.6	--	< 0.02	84700	--	--	< 0.02	--	1.29	1.6	--	3.4	--
SP037	Gay Mine Pond #2 above A-12 Pit	MWH 1998	9/23/1997	NR	1.39	--	--	--	--	--	--	--	--	--	--	--	--
SP037	Gay Mine Pond #2 above A-12 Pit	MWH 2002	5/16/2001	NR	--	--	--	--	--	--	--	--	--	--	--	10	--
SP037	Gay Mine Pond #2 above A-12 Pit	MWH 2002	5/16/2001	NR	1	--	< 2.1	85000	--	--	< 2.5	--	< 8.0	9.5	--	< 10	--
SW-012	Pond 2 above A12 Pit (West)	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	11.7	--	< 5.0	--
SW-012	Pond 2 above A12 Pit (West)	Parametrix 2004	4/6/2004	T	171	--	--	--	--	--	--	--	--	12	--	--	--
SW-012	Pond 2 above A12 Pit (West)	Golder 2017	5/18/2016	D	30.1	--	< 0.003	71800	--	--	0.063	--	48.1	41.7	--	7.1	--
SW-012	Pond 2 above A12 Pit (West)	Golder 2017	5/18/2016	T	30.3	--	0.073	71800	--	--	0.074	--	48.4	41.4	--	14.4	--
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	5/21/2018	D	2.7	--	0.01	65600	--	--	< 0.008	--	3.85	< 1.1	--	2.1	--
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	5/21/2018	T	2.7	--	0.013	68100	--	--	< 0.008	--	3.84	< 1.1	--	2.5	--
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	9/18/2018	D	2.6	--	< 0.009	125000	--	--	< 0.009	--	7.51	12.9	--	< 4.2	--
SW-012	Pond 2 above A12 Pit (West)	Golder 2019	9/18/2018	T	2.9	--	0.073	127000	--	--	0.015	--	7.67	17.1	--	15.9	--
SP038	Gay Mine A-12 Lake in A-12 Pit	MWH 1998	9/23/1997	NR	100	--	--	--	--	--	--	--	--	--	--	--	--
SP038	Gay Mine A-12 Lake in A-12 Pit	MWH 2002	5/16/2001	NR	62	--	< 2.1	80000	--	--	< 2.5	--	8.7	14	--	13	--
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	12.7	--	< 5.0	--
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	T	608	--	--	--	--	--	--	--	--	12.7	--	--	--
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	D	--	--	--	--	--	--	--	--	--	12.6	--	< 5.0	--

Table 1: Surface Water Sample Results

					Analytes (µg/l)												
Sample ID / Location Code	**Location Description**	**Source**	**Sample Date**	**Fraction (Total, Dissolved)**	**Selenium**	**Silicon**	**Silver**	**Sodium**	**Strontium**	**Tellurium**	**Thallium**	**Titanium**	**Uranium**	**Vanadium**	**Yttrium**	**Zinc**	**Zirconium**
SW-013	A12 Lake in A12 Pit	Parametrix 2004	4/6/2004	T	638	--	--	--	--	--	--	--	--	12.7	--	--	--
A12061208[1]	A12 Lake in A12 Pit	SBT 2008	6/12/2008	D	--	--	<1.0	--	--	--	<1.0	--	--	--	--	<30	--
A12061208[1]	A12 Lake in A12 Pit	SBT 2008	6/12/2008	T	1	9040	<1.0	--	355	<1.0	<1.0	<1.0	<0.01	--	<1.0	<30	<1.0
A12061308[1]	A12 Lake in A12 Pit	SBT 2008	6/13/2008	D	--	--	<1.0	--	--	--	<1.0	--	--	--	--	<30	--
A12061308[1]	A12 Lake in A12 Pit	SBT 2008	6/13/2008	T	23	860	<1.0	--	375	<1.0	<1.0	<1.0	<0.01	--	<1.0	<30	<1.0
GM2009-05	A-12 Pit	SBT 2009a	4/28/2009	D	--	--	<1.0	--	--	--	<1.0	--	--	--	--	--	--
GM2009-05	A-12 Pit	SBT 2009a	4/28/2009	T	242	3060	<1.0	--	371	<1.0	<1.0	<5.0	16	--	<1.0	16	--
SW-013	A12 Lake in A12 Pit	Golder 2016	9/1/2015	D	9.4	--	< 0.002	104000	--	--	< 0.008	--	1.970	4.7	--	9.2	--
SW-013	A12 Lake in A12 Pit	Golder 2016	9/1/2015	T	7.6	--	0.043	104000	--	--	0.022	--	2.180	9.3	--	17.9	--
SW-013	A12 Lake in A12 Pit	Golder 2017	5/18/2016	D	183	--	< 0.003	54500	--	--	0.02	--	13	1	--	1.3	--
SW-013	A12 Lake in A12 Pit	Golder 2017	5/18/2016	T	188	--	< 0.003	53800	--	--	0.021	--	13.1	2.6	--	1.4	--
SW-013	A12 Lake in A12 Pit	Golder 2019	5/21/2018	D	86.1	--	< 0.008	59500	--	--	0.093	--	7.4	32.8	--	35.1	--
SW-013	A12 Lake in A12 Pit	Golder 2019	5/21/2018	T	86.8	--	0.009	66100	--	--	0.088	--	7.17	31.6	--	32.9	--
SW-013	A12 Lake in A12 Pit	Golder 2019	9/19/2018	D	81.7	--	< 0.009	70900	--	--	0.061	--	7.52	27.5	--	< 4.2	--
SW-013	A12 Lake in A12 Pit	Golder 2019	9/19/2018	T	82.6	--	< 0.009	70300	--	--	0.060	--	7.56	27.3	--	< 4.2	--

Notes:

1. Coordinates were not provided for sample A12061308, but the sample nomenclature indicates it is likely the A-12 Pit. Coordinates were provided for sample A12061208.

Abbreviations:
-- = Analyte not sampled
ND = Analyte not detected, < detection limit provided in text
NR = Not reported
D = Sample filtered prior to analysis to determine dissolved concentration of analytes
T = Sample was not filtered prior to analysis to determine the total concentration of analyted (dissolved and adhered to particulates)
N = 'Normal' fraction
SBT = Shoshone-Bannock Tribes

Table 2: Summary of Estimated Alternative Costs

Alternative	Total Cost
A - North Pipeline / Ditch	$771,000
B - South Pipeline / Ditch	$609,000

Table 3: Cost Estimate for Alternative A - North Pipeline / Ditch

Item	Quantity	Units	Unit Cost	Cost
Capital Costs				
Mob/demob heavy equipment	1	ls	$ 10,000	$ 10,000
Temporary facilities	2	mo	$ 5,000	$ 10,000
Improve access and other site preparation	1	ls	$ 10,000	$ 10,000
Clear and grub	4.2	acres	$ 1,300	$ 5,449
Excavate trench for pipeline and stockpile material	3,372	lf	$ 12.95	$ 43,658
Pipeline (incl material) in-place	3,372	lf	$ 96.70	$ 326,067
Backfill trench with stockpiled native soil material	16,552	lcy	$ 2.49	$ 41,216
Compact native soil trench backfill	15,048	bcy	$ 1.00	$ 15,048
Excavate and install rock-lined ditch (North Alignment)	1,213	lf	$ 19.47	$ 23,615
Install outlet protection at pipeline discharge	3	cy	$ 75.00	$ 222
Excavate and install HDPE lined portion of extended ditch	200	lf	$ 25.20	$ 5,040
Excavate unlined portion of extended ditch	1,275	bcy	$ 5.05	$ 6,439
Install additional rock for swale across road	111	cy	$ 60.00	$ 6,667
Seed disturbed areas	4.6	acres	$ 2,134	$ 9,802
Subtotal				$ 513,223
Contingency, construction			20%	$ 103,000
Design	1	ls	$ 80,000	$ 80,000
Construction oversight	2	mo	$ 30,000	$ 60,000
Construction summary report	1	ls	$ 15,000	$ 15,000
TOTAL COSTS				**$ 771,000**

Notes:
[a] Refer to Appendix C for quantity calculations and unit cost source information.

Abbreviations:
- cy = cubic yard
- bcy = bank cubic yard
- lcy = loose cubic yard
- lf = linear foot
- ls = lump sum
- mo = month

February 2020 10393418-19.900

Table 4: Cost Estimate for Alternative B - South Pipeline / Ditch

Item	Quantity	Units	Unit Cost	Cost
Capital Costs				
Mob/demob heavy equipment	1	ls	$ 10,000	$ 10,000
Temporary facilities	2	mo	$ 5,000	$ 10,000
Improve access and other site preparation	1	ls	$ 10,000	$ 10,000
Clear and grub	3.9	acres	$ 1,300	$ 5,078
Excavate trench for pipeline and stockpile material	1,486	lf	$ 34.38	$ 51,085
Pipeline (incl material) in-place	1,486	lf	$ 96.70	$ 143,694
Backfill trench with stockpiled native soil material	20,665	lcy	$ 2.49	$ 51,455
Compact native soil trench backfill	18,786	bcy	$ 1.00	$ 18,786
Excavate and install rock-lined ditch (South Alignment)	2,264	lf	$ 22.49	$ 50,922
Install enery dissipation structure at pipeline discharge	9	cy	$ 75.00	$ 667
Excavate and install HDPE lined portion of extended ditch	200	lf	$ 25.20	$ 5,040
Excavate unlined portion of extended ditch	1,275	bcy	$ 5.05	$ 6,439
Install additional rock for swale across road	111	cy	$ 60.00	$ 6,667
Seed disturbed areas	3.6	acres	$ 2,134	$ 7,671
Subtotal				$ 377,503
Contingency, construction			20%	$ 76,000
Design	1	ls	$ 80,000	$ 80,000
Construction oversight	2	mo	$ 30,000	$ 60,000
Construction summary report	1	ls	$ 15,000	$ 15,000
TOTAL COSTS				**$ 609,000**

Notes:

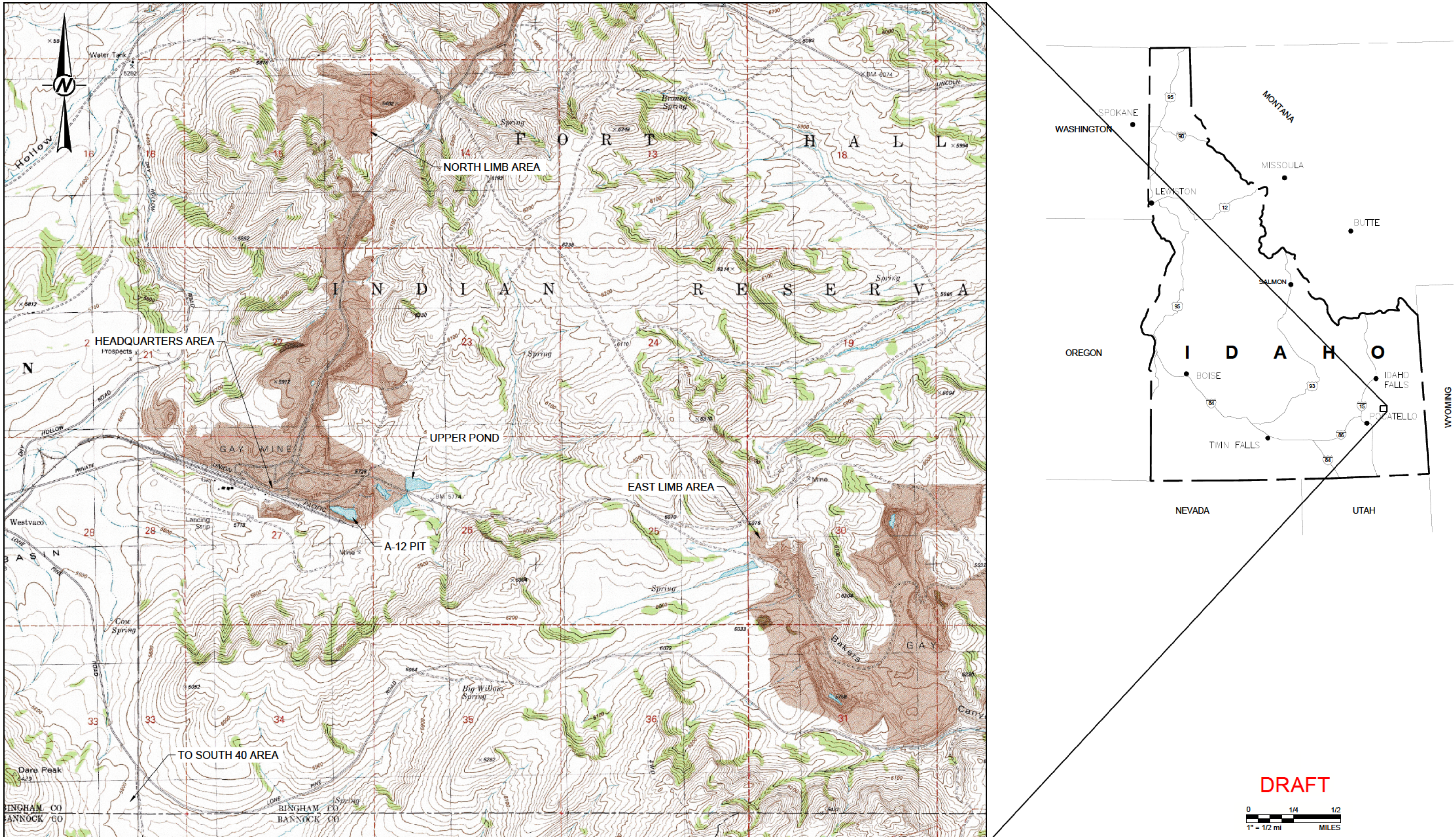
[a] Refer to Appendix C for quantity calculations and unit cost source information.

Abbreviations:

cy = cubic yard
bcy = bank cubic yard
lcy = loose cubic yard
lf = linear foot
ls = lump sum
mo = month

GOLDER

Figures



SOURCE: USGS

GAY MINE AREA

DRAFT

CLIENT	FMC/SIMPLOT
PROJECT	GAY MINE A-12 PIT SURFACE WATER DIVERSION WORK PLAN
CONSULTANT	GOLDER
YYYY-MM-DD	2020-01-27
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	JC
TITLE	**SITE LOCATION MAP**
PROJECT NO.	1039341816
PHASE	900
REV.	A
FIGURE	1

LEGEND

5800	MAJOR CONTOUR (100-FT INTERVAL)
	MINOR CONTOUR (20-FT INTERVAL)
====	ROAD
┼┼┼┼┼┼┼	RAILROAD
△	MAJOR SPR NG

NOTES

HORIZONTAL DATUM: NAD 83 DAHO STATE PLANE, EAST ZONE, US FOOT

VERTICAL DATUM: NAVD 88, FEET

AERIAL: USDA-NAIP MAGERY, 2009

TOPOGRAPHY: GOLDER GIS, 11-29-2012

TOPOGRAPHY GENERATED N AUTOCAD CIV L 3D USING A DIGITAL SURFACE MODEL (DSM) AND 2-FOOT CONTOURS EXTRACTED BY GOLDER ASSOCIATES NC. FROM 0.5-METER RESOLUTION GEOEYE1 STEREO SATELLITE IMAGERY. THE TOPOGRAPHY NDICATES THE ELEVATION OF THE GROUND AND ABOVEGROUND FEATURES PRESENT AT THE TIME OF MAGE ACQUISITION (JUNE 2, 2011). THE GROUND RESOLUTION IS 3 2 FEET (1 METER).

DRAFT

0 500 1000
1" = 1000' FEET

CLIENT
FMC/SIMPLOT

PROJECT
GAY MINE
A-12 PIT SURFACE WATER DIVERSION WORK PLAN

CONSULTANT
GOLDER

YYYY-MM-DD	2020-01-27
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	JC

TITLE
SITE LAYOUT

PROJECT NO.	PHASE	REV.	FIGURE
1039341816	900	A	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

LEGEND

— 5800 — MAJOR CONTOUR (50-FT INTERVAL)

M NOR CONTOUR (10-FT NTERVAL)

ROAD

RA LROAD

PARAMETRIX (2004) SURFACE WATER SAMPLE LOCATION

MWH (1997 AND 2001) SURFACE WATER SAMPLE LOCATION

SHOSHONE-BANNOCK TRIBES (2008 AND 2009) SURFACE WATER SAMPLE LOCATION

NOTES

HORIZONTAL DATUM: NAD 83 DAHO STATE PLANE, EAST ZONE, US FOOT

VERTICAL DATUM: NAVD 88, FEET

AERIAL: USDA-NAIP IMAGERY, 2009

TOPOGRAPHY: GOLDER GIS, 11-29-2012

TOPOGRAPHY GENERATED N AUTOCAD CIV L 3D USING A DIGITAL SURFACE MODEL (DSM) AND 2-FOOT CONTOURS EXTRACTED BY GOLDER ASSOCIATES NC. FROM 0.5-METER RESOLUTION GEOEYE1 STEREO SATELLITE IMAGERY. THE TOPOGRAPHY NDICATES THE ELEVATION OF THE GROUND AND ABOVEGROUND FEATURES PRESENT AT THE TIME OF MAGE ACQUISITION (JUNE 2, 2011). THE GROUND RESOLUTION IS 3 2 FEET (1 METER).

DRAFT

0 250 500
1" = 500' FEET

CLIENT
FMC/SIMPLOT

PROJECT
GAY MINE
A-12 PIT SURFACE WATER DIVERSION WORK PLAN

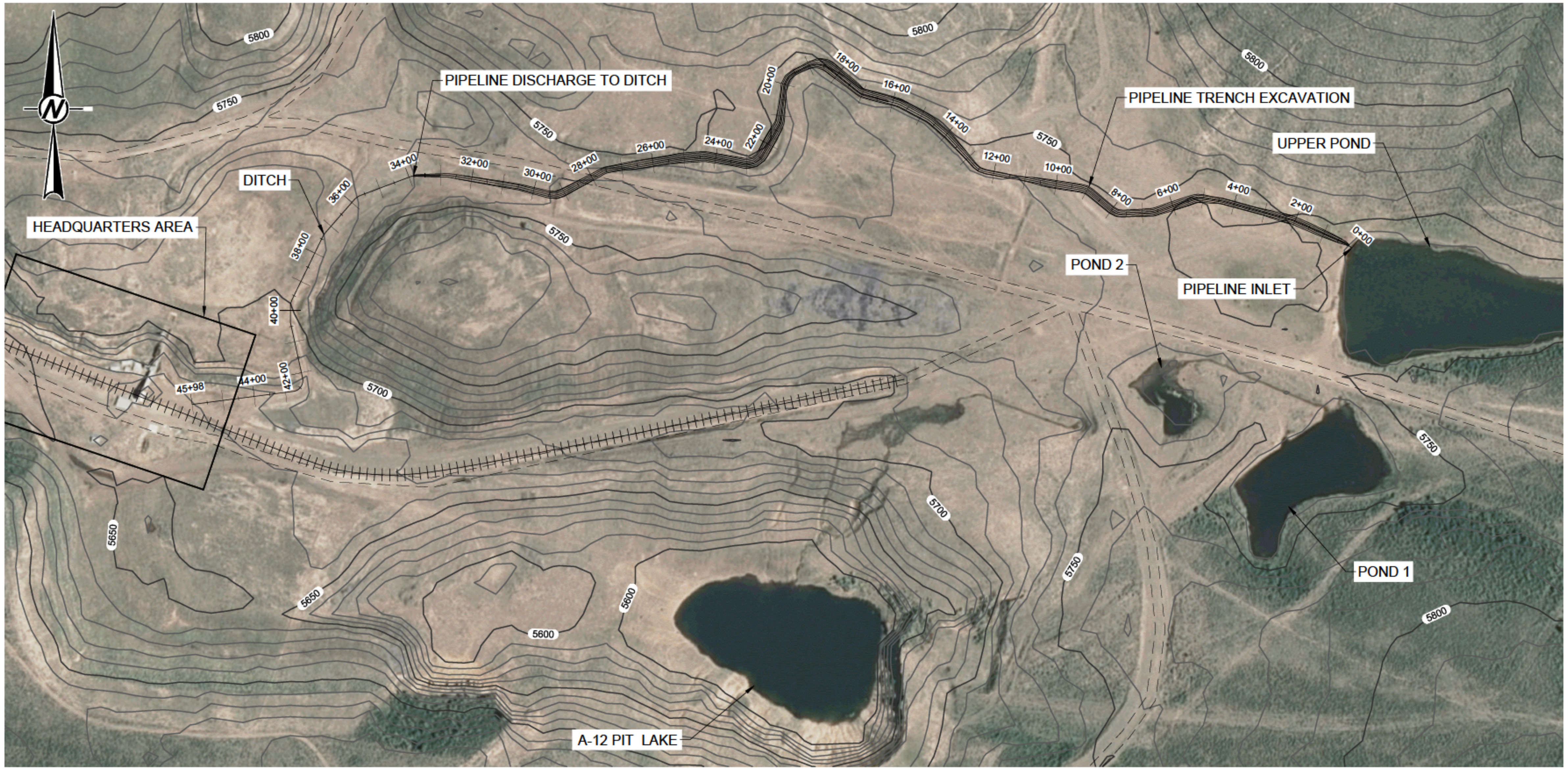
CONSULTANT
GOLDER

YYYY-MM-DD	2020-01-27
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	JC

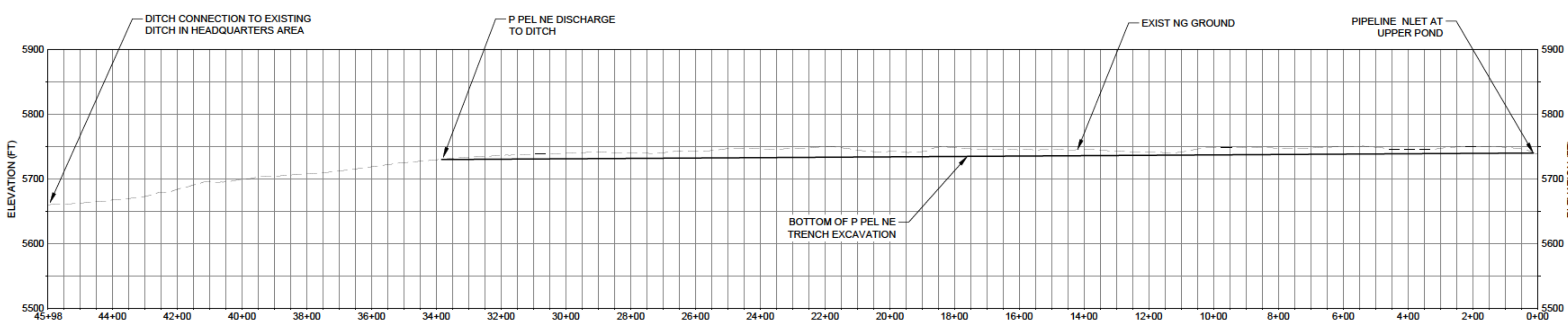
TITLE
SURFACE WATER SAMPLE LOCATIONS

PROJECT NO.	PHASE	REV.	FIGURE
1039341816	900	A	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



PLAN VIEW OF NORTH ALIGNMENT



PROFILE ALONG NORTH ALIGNMENT
(2X VERTICAL EXAGGERATION)

LEGEND

— 5800 —	MAJOR CONTOUR (50-FT INTERVAL)
———	M NOR CONTOUR (10-FT NTERVAL)
= = = =	ROAD
┼┼┼┼┼┼┼┼	RA LROAD

NOTES

HORIZONTAL DATUM: NAD 83 IDAHO STATE PLANE, EAST ZONE, US FOOT

VERTICAL DATUM: NAVD 88, FEET

AERIAL: USDA-NAIP IMAGERY, 2009

TOPOGRAPHY: GOLDER GIS, 11-29-2012

TOPOGRAPHY GENERATED N AUTOCAD CIV L 3D USING A DIGITAL SURFACE MODEL (DSM) AND 2-FOOT CONTOURS EXTRACTED BY GOLDER ASSOCIATES INC. FROM 0.5-METER RESOLUTION GEOEYE1 STEREO SATELLITE IMAGERY. THE TOPOGRAPHY INDICATES THE ELEVATION OF THE GROUND AND ABOVEGROUND FEATURES PRESENT AT THE TIME OF MAGE ACQUISITION (JUNE 2, 2011). THE GROUND RESOLUTION IS 3 2 FEET (1 METER).

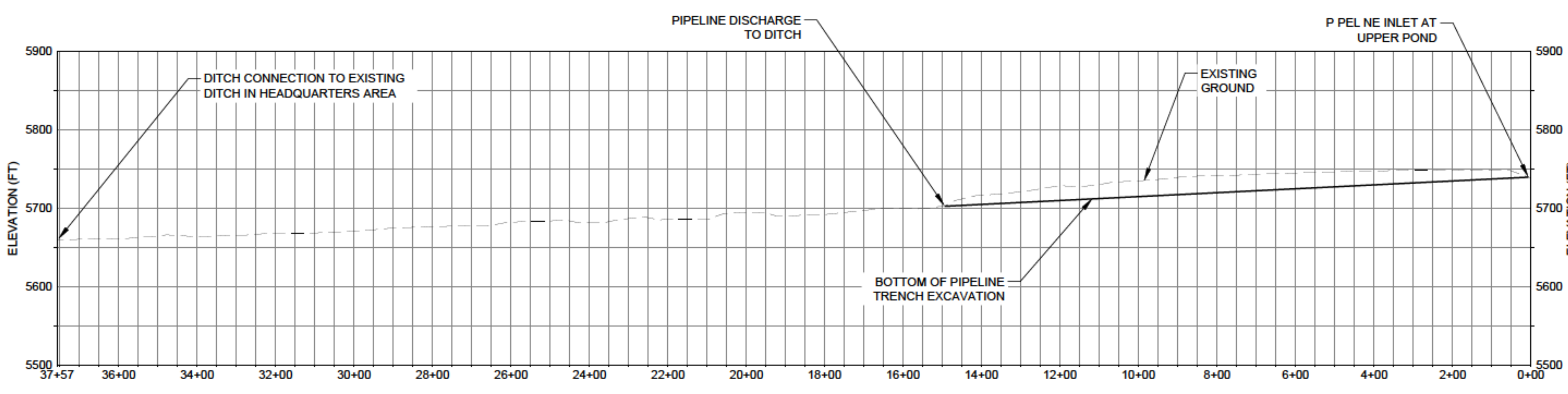
THE ALIGNMENT SHOWN IS A SLIGHTLY MOD F ED VERSION OF THE SOUTH ALIGNMENT SURVEYED BY A&E ENG NEERING, INC. ON 8-2-2012.

DRAFT

0 200 400
1" = 400' FEET

CLIENT	FMC/SIMPLOT
PROJECT	GAY MINE A-12 PIT SURFACE WATER DIVERSION WORK PLAN
CONSULTANT	GOLDER
YYYY-MM-DD	2020-01-27
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	JC
TITLE	ALTERNATIVE A - NORTH PIPELINE/DITCH PLAN AND PROFILE
PROJECT NO.	1039341816
PHASE	900
REV.	A
FIGURE	4

PLAN VIEW OF SOUTH ALIGNMENT



PROFILE ALONG SOUTH ALIGNMENT
(2X VERTICAL EXAGGERATION)

LEGEND

— 5800 — MAJOR CONTOUR (50-FT INTERVAL)

M NOR CONTOUR (10-FT NTERVAL)

ROAD

RA LROAD

NOTES

HORIZONTAL DATUM: NAD 83 IDAHO STATE PLANE, EAST ZONE, US FOOT

VERTICAL DATUM: NAVD 88, FEET

AERIAL: USDA-NAIP IMAGERY, 2009

TOPOGRAPHY: GOLDER GIS, 11-29-2012

TOPOGRAPHY GENERATED N AUTOCAD CIV L 3D USING A DIGITAL SURFACE MODEL (DSM) AND 2-FOOT CONTOURS EXTRACTED BY GOLDER ASSOCIATES INC. FROM 0.5-METER RESOLUTION GEOEYE1 STEREO SATELLITE IMAGERY. THE TOPOGRAPHY INDICATES THE ELEVATION OF THE GROUND AND ABOVEGROUND FEATURES PRESENT AT THE TIME OF MAGE ACQUISITION (JUNE 2, 2011). THE GROUND RESOLUTION IS 3 2 FEET (1 METER).

THE ALIGNMENT SHOWN IS A SLIGHTLY MOD F ED VERSION OF THE SOUTH ALIGNMENT SURVEYED BY A&E ENG NEERING, INC. ON 8-2-2012.

DRAFT

0 200 400
1" = 400' FEET

CLIENT
FMC/SIMPLOT

PROJECT
GAY MINE
A-12 PIT SURFACE WATER DIVERSION WORK PLAN

CONSULTANT

GOLDER

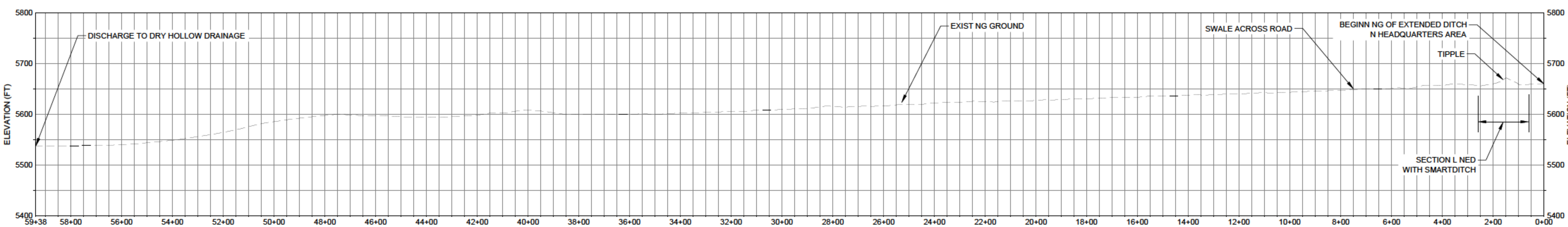
YYYY-MM-DD	2020-01-27
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	JC

TITLE
ALTERNATIVE B - SOUTH PIPELINE/DITCH PLAN AND PROFILE

PROJECT NO.	PHASE	REV.	FIGURE
1039341816	900	A	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

PLAN VIEW OF EXTENDED DITCH ALIGNMENT



PROFILE ALONG EXTENDED DITCH ALIGNMENT
(2X VERTICAL EXAGGERATION)

0 200 400
1" = 400' FEET

NOTES

HORIZONTAL DATUM: NAD 83 IDAHO STATE PLANE, EAST ZONE, US FOOT

VERTICAL DATUM: NAVD 88, FEET

AERIAL: USDA-NA P IMAGERY, 2009

TOPOGRAPHY: GOLDER GIS, 11-29-2012

TOPOGRAPHY GENERATED IN AUTOCAD CIVIL 3D US NG A DIGITAL SURFACE MODEL (DSM) AND 2-FOOT CONTOURS EXTRACTED BY GOLDER ASSOCIATES INC. FROM 0 5-METER RESOLUTION GEOEYE1 STEREO SATELLITE MAGERY. THE TOPOGRAPHY INDICATES THE ELEVATION OF THE GROUND AND ABOVEGROUND FEATURES PRESENT AT THE T ME OF IMAGE ACQUISITION (JUNE 2, 2011). THE GROUND RESOLUTION IS 3.2 FEET (1 METER).

THE ALIGNMENT SHOWN IS A SLIGHTLY MODIFIED VERSION OF THE SOUTH ALIGNMENT SURVEYED BY A&E ENGINEER NG, NC. ON 8-2-2012.

LEGEND

—— 5800 ——	MAJOR CONTOUR (50-FT INTERVAL)
————	MINOR CONTOUR (10-FT INTERVAL)
= = = =	ROAD
┼┼┼┼┼┼┼	RA LROAD

DRAFT

CLIENT
FMC/SIMPLOT

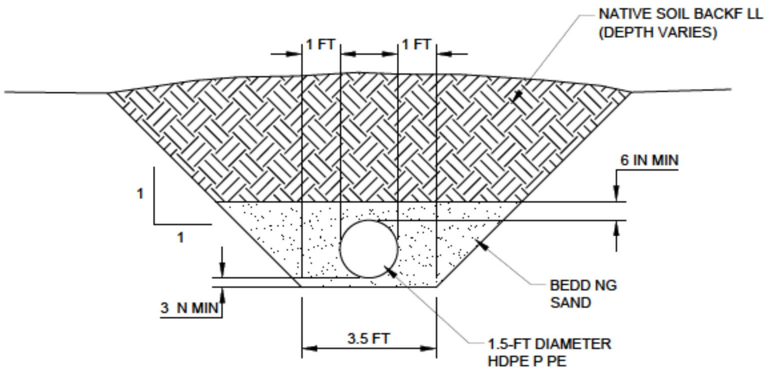
PROJECT
GAY MINE
A-12 PIT SURFACE WATER DIVERSION WORK PLAN

CONSULTANT
GOLDER

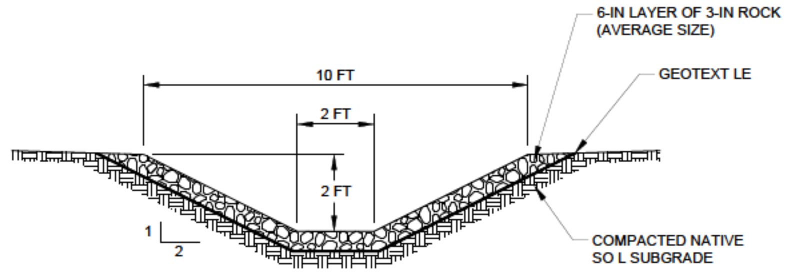
YYYY-MM-DD	2020-01-27
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	JC

TITLE
EXTENDED DITCH PLAN AND PROFILE

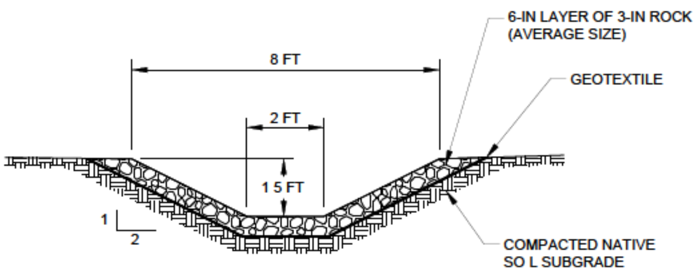
PROJECT NO.	PHASE	REV.	FIGURE
1039341816	900	B	6



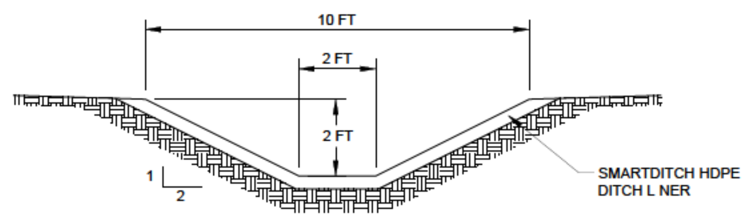
TYPICAL SECTION 1: PIPELINE TRENCH



TYPICAL SECTION 3: SOUTH ALIGNMENT DITCH



TYPICAL SECTION 2: NORTH ALIGNMENT DITCH



TYPICAL SECTION 4: SECTION OF EXTENDED DITCH LINED WITH SMARTDITCH

DRAFT

CLIENT
FMC/SIMPLOT

PROJECT
GAY MINE
A-12 PIT SURFACE WATER DIVERSION WORK PLAN

CONSULTANT

GOLDER

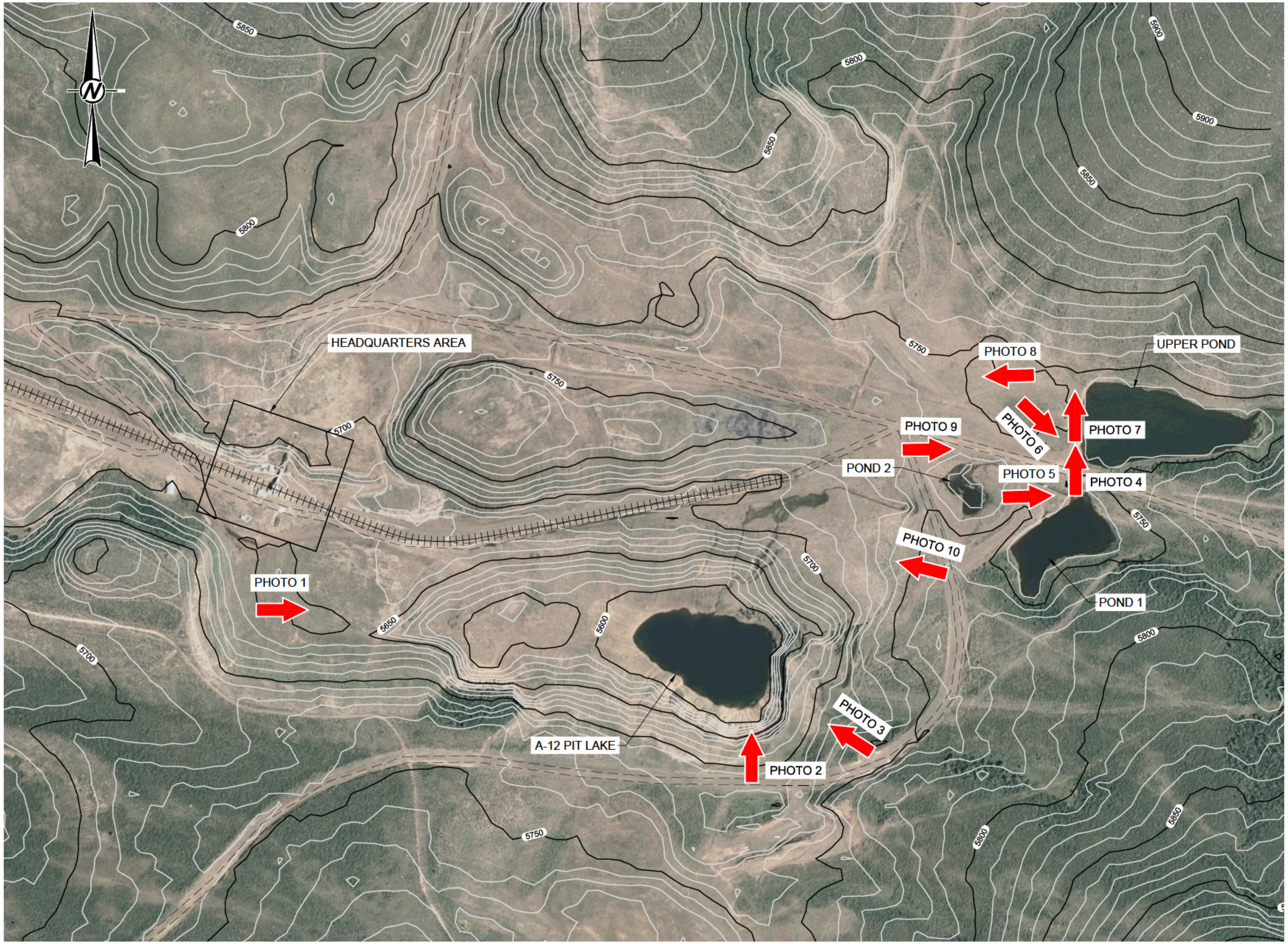
YYYY-MM-DD	2020-01-27
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	JC

TITLE
TYPICAL SECTIONS

PROJECT NO.	PHASE	REV.	FIGURE
1039341816	900	B	7

APPENDIX A

Gay Mine A-12 Pit Area Photographs



LEGEND

- 5800 — MAJOR CONTOUR (50-FT INTERVAL)
- M NOR CONTOUR (10-FT NTERVAL)
- ROAD
- RA LROAD
- PHOTO 5 — PHOTO NUMBER AND D RECTION

NOTES

HORIZONTAL DATUM: NAD 83 DAHO STATE PLANE, EAST ZONE, US FOOT

VERTICAL DATUM: NAVD 88, FEET

AERIAL: USDA-NAIP MAGERY, 2009

TOPOGRAPHY: GOLDER GIS, 11-29-2012

TOPOGRAPHY GENERATED N AUTOCAD CIV L 3D USING A DIGITAL SURFACE MODEL (DSM) AND 2-FOOT CONTOURS EXTRACTED BY GOLDER ASSOCIATES NC. FROM 0.5-METER RESOLUTION GEOEYE1 STEREO SATELLITE IMAGERY. THE TOPOGRAPHY NDICATES THE ELEVATION OF THE GROUND AND ABOVEGROUND FEATURES PRESENT AT THE TIME OF MAGE ACQUISITION (JUNE 2, 2011). THE GROUND RESOLUTION IS 3 2 FEET (1 METER).

DRAFT

0 250 500
1" = 500' FEET

CLIENT	
FMC/SIMPLOT	

CONSULTANT
GOLDER

YYYY-MM-DD	2020-01-27
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	JC

PROJECT
GAY MINE
A-12 PIT SURFACE WATER DIVERSION WORK PLAN

TITLE
PHOTO KEY MAP

PROJECT NO.	PHASE	REV.	FIGURE
1039341816	900	A	A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Gay Mine A-12 Pit Area Photographs

PHOTOGRAPH 1

View of eastern side of A-12 Pit (looking east)

5-25-2011

PHOTOGRAPH 2

View of northern side of A-12 Pit and drainage (looking north)

5-25-2011

PHOTOGRAPH 3

View of western end of A-12 Pit; Headquarters Area in background (looking west)

5-25-2011

PHOTOGRAPH 4

View of western portion of Upper Pond and embankment (looking north)

5-25-2011

PHOTOGRAPH 5

Discharge outlet to Pond 1 from Upper Pond (looking east)

5-25-2011

PHOTOGRAPH 6

Discharge inlet from Upper Pond to Pond 1; view of southwest corner of Upper Pond; beginning of south alignment for potential diversion (looking southeast)

8-2-2012

PHOTOGRAPH 7

View of embankment at northwest corner of Upper Pond; beginning of north alignment for potential diversion (looking north)

8-2-2012

PHOTOGRAPH 8

Typical view west along north alignment

8-2-2012

PHOTOGRAPH 9

View down road and back toward Upper Pond; beginning section of south alignment for potential diversion (looking southeast)

8-2-2012

PHOTOGRAPH 10

View from road running north-south between the A-12 Pit and ponds back toward Headquarters Area (looking west); ditch for south alignment runs from right to left along cut bench in middle of photo

8-2-2012

PHOTOGRAPH 11

View of A-12 Pit.

Fall 2015

PHOTOGRAPH 12

View of A-12 Pit.

Spring 2016

PHOTOGRAPH 13

View of A-12 Pit.

Spring 2018

PHOTOGRAPH 14

View of A-12 Pit.

Fall 2018

APPENDIX B

Hydrology And Hydraulics Calculations

GOLDER

CALCULATIONS

Date:	2/7/2019	**Made by:**	VMN
Project No.:	103-93418-12.001.150	**Checked by:**	FSS/SJS 2/7/19
Subject:	Hydrology & Hydraulics Calculations	**Reviewed by:**	CLC
Project Short Title:	Gay Mine A-12 Pit Diversion		

OBJECTIVE

Design of a diversion pipeline / ditch to prevent discharge from the Upper Pond to the A-12 Pit. Per "the Companies," the Upper Pond is to be used as a reservoir with its storage capacity maximized and the diversion pipeline / ditch sized to convey the peak flow from the 25-year, 24-hour storm event. Peak flows contributing to the Upper Pond will be determined in HEC-HMS for several design storm events based on the hydrologic parameters developed and data input for modeling of the Upper Pond as a reservoir. Using Flowmaster, pipe size / ditch dimensions will be determined for the peak flow from the 25-year, 24-hour event. Diversion pipeline / ditch alternatives will be analyzed along two different alignments (north and south).

HYDROLOGIC PARAMETERS

Parameters to be developed for the hydrologic analysis include:

- Design Storm Event
- Storm Distribution
- Drainage Basin Areas
- Soil Type and Curve Number
- Time of Concentration

Design Storm Event

Several storm events were evaluated to get a range of peak flows contributing to the Upper Pond.

Site-specific values for the 2-year and 100-year events were obtained using the NOAA Atlas 2 Site-Specific Precipitation-Frequency Estimates (NOAA 2012) at 43.06 N, -112.09 W.

The precipitation amounts for the other storm events were obtained from the NOAA Atlas 2 Precipitation-Frequency (Isopluvial) Maps (NOAA 1973).

Storm Event	*Precipitation (in)*	*Source*
2-yr, 24-hr	1.42	NOAA Atlas 2, Site-Specific Precipitation-Frequency Estimates
10-yr, 24-hr	2.10	NOAA Atlas 2 Map
25-yr, 24-hr	2.30	NOAA Atlas 2 Map
50-yr, 24-hr	2.70	NOAA Atlas 2 Map
100-yr, 24-hr	3.01	NOAA Atlas 2, Site-Specific Precipitation-Frequency Estimates

Storm Distribution

The NRCS Type 2 Storm Distribution was selected from the TR-55 Manual (NRCS 1986), Figure B-2, based on geographic region.

Drainage Basin Areas and Curve Number Determination

The drainage basin contributing to the Upper Pond was delineated in AutoCAD Civil 3D (see attached Figure A).

Area (acres)	*Area (mi^2)*
1,087	1.70

The drainage basin hydrologic soil group and cover type was identified to determine the curve number (CN) from the TR-55 Manual (NRCS 1986).

According to the NRCS SSURGO Database (NRCS 2012), soils in the area are silt loams, categorized as Hydrologic Soil Group B.
The cover type was selected from Table 2-2d (NRCS 1986) for arid and semiarid rangelands: Herbaceous—mixture of grass, weeds and low-growing brush, with brush the minor element.

CN = 71 (Table 2-2d, fair condition)

The initial loss (inches) was also estimated for the drainage basin:
Initial Loss = 0.2((1000/CN)-10) = 0.82

Time of Concentration

The time of concentration (Tc) was determined for the Upper Pond Drainage Basin.
The Tc calculation is presented in the attached sheet.

Once Tc is calculated, SCS Lag is calculated as a function for input into the model:
*SCS Lag (min) = (0.6*Tc)*

	Tc	***SCS Lag (min)***
Upper Pond Drainage Basin	62	37.3

HEC-HMS MODEL

The HEC-HMS Model was run for each storm event using the NRCS Type 2 Storm Distribution. The hydrologic parameters presented above were input into the model for the drainage basin contributing to the Upper Pond. The Upper Pond was modeled as a reservoir downstream of the drainage basin with an outlet to the A-12 Pit diversion pipeline. Peak flows into the reservoir and out of the reservoir into the diversion pipeline are presented below.

Data Input for Upper Pond (Reservoir)

Initial elevation set at 5,740' - assumed capacity above base storage based on the following:

1) During the August 2, 2012 survey by A&E Engineering, Inc the water level was at 5,738.4' and the invert of the existing 24" CMP (outlet from Upper Pond to Pond 1, to be plugged) was at 5,739.4'.
2) According to the 2009 NAIP aerial and November 2012 2-ft contour topography, water level at about 5,740'.

Elevation at which Upper Pond would be overtopped set at 5,748' because last containing contour according to November 2012 2-ft topography.

The following data was determined in AutoCAD Civil 3D and entered into the model to create an elevation-area curve:

Elevation (ft)	***Area (ac)***
5,740	5.53
5,742	6.15
5,744	6.89
5,746	7.72
5,748	8.69

Modeling Along South Alignment

Along the south alignment, a pipeline would extend approximately 1,500 feet from the Upper Pond (reservoir) to a 2,300-foot long rock-lined ditch. The 2,300-foot long rock-lined ditch would then connect into the existing ditch in the Headquarters Area on the north side of the railroad, which would be upgraded to the required size from this location to the discharge point at Dry Hollow Drainage.
An outlet from the reservoir (the pipeline) was included with its inlet invert set at 5,740' and outlet invert set at 5,704' (transition to lined ditch).
The goal is to maximize storage in the Upper Pond (max peak elevation of 5,746') and minimize ditch / pipeline size.

With a 1.5-ft diameter outlet (diversion pipeline), the results are as follows:

	Into Reservoir		Out of Reservoir	
Storm Event	**Peak Q (cfs)**	**Volume (ac-ft)**	**Peak Q (cfs)**	**Volume (ac-ft)**
2-yr, 24-hr	14.5	7.0	2.7	5.3
10-yr, 24-hr	121.8	27.7	14.0	25.4
25-yr, 24-hr	171.7	35.7	17.7	33.3
50-yr, 24-hr	288.7	53.7	18.2	50.5
100-yr, 24-hr	394.3	69.3	18.6	65.0

With a 1.5-ft diameter outlet (diversion pipeline), the Upper Pond rises to the following peak elevations:

Storm Event	Peak Elevation (ft)
2-yr, 24-hr	5,740.9
10-yr, 24-hr	5,742.6
25-yr, 24-hr	5,743.4
50-yr, 24-hr	5,745.5
100-yr, 24-hr	5,747.4

A 1.5-ft diameter pipeline is recommended to adequately convey the peak flow from the 25-year, 24-hour storm event without exceeding a max peak elevation of 5,746' in the Upper Pond. Modeling was also performed for a 1-ft and 2-ft diameter pipeline, and using alternate hydrologic parameters. Through this analysis, a 1.5-ft diameter pipeline was determined to be conservative for the range of hydrologic conditions that could actually be present at the site. Using a 1.5-ft diameter pipeline and the assumptions outlined above, the pipeline would convey the peak flow up through the 50-year, 24-hour storm event without exceeding the max peak elevation of 5,746'. The 100-year, 24-hour peak flow would also be conveyed without overtopping.

Modeling Along North Alignment

Along the north alignment, a pipeline would extend approximately 3,400 feet from the Upper Pond (reservoir) to a 1,200-foot long rock-lined ditch. The 1,200-foot long rock-lined ditch would then connect into the existing ditch in the Headquarters Area on the north side of the railroad, which would be upgraded to the required size from this location to the discharge point at Dry Hollow Drainage.

An outlet from the reservoir (the pipeline) was included with its inlet invert set at 5,740' and outlet invert set at 5,730' (transition to lined ditch).

The goal is to maximize storage in the Upper Pond (max peak elevation of 5,746') and minimize ditch / pipeline size.

With a 1.5-ft diameter outlet (diversion pipeline), the results are as follows:

	Into Reservoir		Out of Reservoir	
Storm Event	**Peak Q (cfs)**	**Volume (ac-ft)**	**Peak Q (cfs)**	**Volume (ac-ft)**
2-yr, 24-hr	14.5	7.0	2.7	5.3
10-yr, 24-hr	121.8	27.7	7.0	24.6
25-yr, 24-hr	171.7	35.7	7.3	31.0
50-yr, 24-hr	288.7	53.7	7.8	36.5
100-yr, 24-hr	394.3	69.3	overtopped (above 5,748')	

With a 1.5-ft diameter outlet (diversion pipeline), the Upper Pond rises to the following peak elevations:

Storm Event	Peak Elevation (ft)
2-yr, 24-hr	5,740.9
10-yr, 24-hr	5,743.4
25-yr, 24-hr	5,744.5
50-yr, 24-hr	5,746.8
100-yr, 24-hr	overtopped

A 1.5-ft diameter pipeline is recommended to adequately convey the peak flow from the 25-year, 24-hour storm event without exceeding a max peak elevation of 5,746' in the Upper Pond. Modeling was also performed for a 1-ft and 2-ft diameter pipeline, and using alternate hydrologic parameters. Through this analysis, a 1.5-ft diameter pipeline was determined to be conservative for the range of hydrologic conditions that could actually be present at the site. Using a 1.5-ft diameter pipeline and the assumptions outlined above, the pipeline would convey the peak flow up through the 25-year, 24-hour storm event without exceeding the max peak elevation of 5,746'. The 50-year, 24-hour peak flow would also be conveyed without overtopping. The Upper Pond would be overtopped during the 100-year, 24-hour storm event.

FLOWMASTER ANALYSIS

Flowmaster was used to size the ditch along each alignment for the peak flow from the 25-year, 24-hour storm event, with a minimum of 0.5 feet of freeboard. The velocity in the ditch, and at the discharge from the 1.5-ft pipeline to the ditch, were also checked. A summary of the results is presented below.

<u>Ditch along south alignment from STA 14+93 to 37+57:</u>

Channel Dimensions:	Trapezoidal, 2-ft depth, 2-ft bottom width, 2H:1V side slopes (10-ft top width)	
Roughness Coefficient:	0.069	Lined with rock
Slope:	0.019	

Storm Event	***Peak Q (cfs)***	***Normal Depth of Flow (ft)***	***Velocity (ft/s)***
25-yr, 24-hour	17.7	1.41	2.60

<u>Pipeline max discharge velocity to ditch at STA 14+93 along south alignment:</u>

Pipe Type:	Smooth-walled HDPE		Elevation 1:	5,740	ft
Roughness Coefficient:	0.012		Elevation 2:	5,704	ft
Diameter:	1.5	ft	Pressure 1:	6	ft water, reservoir full
Length:	1,486	ft	Pressure 2:	0	ft water

Discharge velocity = 10.83 ft/s

<u>Ditch along north alignment from STA 33+85 to 45+98:</u>

Channel Dimensions:	Trapezoidal, 1.5-ft depth, 2-ft bottom width, 2H:1V side slopes (8-ft top width)	
Roughness Coefficient:	0.069	Lined with rock
Slope:	0.058	

Storm Event	***Peak Q (cfs)***	***Normal Depth of Flow (ft)***	***Velocity (ft/s)***
25-yr, 24-hr	7.3	0.70	3.10

<u>Pipeline max discharge velocity to ditch at STA 33+85 along north alignment:</u>

Pipe Type:	Smooth-walled HDPE		Elevation 1:	5,740	ft
Roughness Coefficient:	0.012		Elevation 2:	5,730	ft
Diameter:	1.5	ft	Pressure 1:	6	ft water, reservoir full
Length:	3,372	ft	Pressure 2:	0	ft water

Discharge velocity = 4.43 ft/s

CONCLUSION

For both the north and south alignments, the Upper Pond is to be used as a reservoir with storage capacity up to a maximum peak elevation of 5,746'. A 1.5-ft diameter pipeline was determined to be the appropriate pipeline size (reservoir outlet) along each alignment to convey the peak flow from the 25-year, 24-hour storm event without exceeding the storage capacity of the Upper Pond. Along the north alignment, the pipeline would extend approximately 3,400 feet before discharging to a 1,200-ft long rock-lined trapezoidal ditch with a 1.5-ft depth, 2-ft bottom width, and 2H:1V side slopes. Along the south alignment, the pipeline would extend approximately 1,500 feet before discharging to a 2,300-ft long rock-lined trapezoidal ditch with a 2-ft depth, 2-ft bottom width, and 2H:1V side slopes. Ditches along both alignments would connect into the existing ditch in the Headquarters Area on the north side of the railroad.

REFERENCES

National Oceanic and Atmospheric Administration (NOAA), 1973, NOAA Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume V – Idaho.

NOAA, NOAA Atlas 2 Site-Specific Precipitation-Frequency Estimates, Accessed December 20, 2012. http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm

Natural Resources Conservation Service (NRCS), 1986, Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55).

NRCS, Soil Survey Geographic (SSURGO) Database, Accessed December 20, 2012. http://soils.usda.gov/survey/geography/ssurgo/

The HEC-HMS Model was run for all storm events (2-yr through 100-yr) for the NRCS Type II Storm Distribution along the north and south alignments.

South Alignment, 1.5-ft diameter pipeline

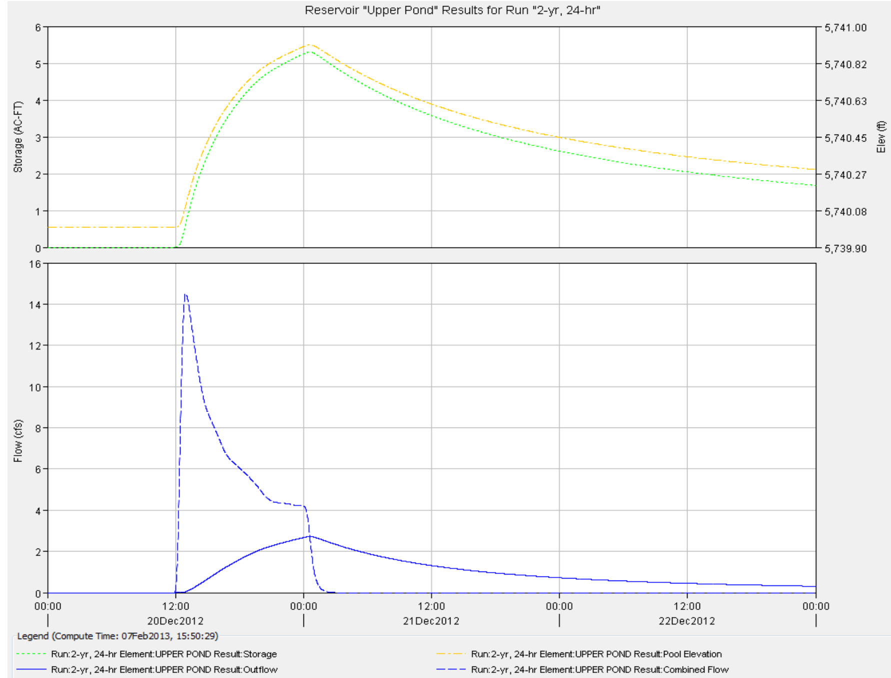
2-yr, 24-hr Storm Event

Project: Gay Mine A-12 Pit Diversion   Simulation Run: 2-yr, 24-hr

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 2-yr, 24-hr
Compute Time: 07Feb2013, 15:50:29   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN AC-FT   Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DA 1	1.7	14.5	20Dec2012, 12:57	7.0
Upper Pond	1.7	2.7	21Dec2012, 00:31	5.3



Project: Gay Mine A-12 Pit Diversion
Simulation Run: 2-yr, 24-hr   Reservoir: Upper Pond

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 2-yr, 24-hr
Compute Time: 07Feb2013, 15:50:29   Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow : 14.5 (CFS)   Date/Time of Peak Inflow : 20Dec2012, 12:57
Peak Outflow : 2.7 (CFS)   Date/Time of Peak Outflow : 21Dec2012, 00:31
Total Inflow : 7.0 (AC-FT)   Peak Storage : 5.3 (AC-FT)
Total Outflow : 5.3 (AC-FT)   Peak Elevation : 5740.9 (FT)

10-yr, 24-hr Storm Event

Project: Gay Mine A-12 Pit Diversion Simulation Run: 10-yr, 24-hr

Start of Run: 20Dec2012, 00:00 Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00 Meteorologic Model: 10-yr, 24-hr
Compute Time: 07Feb2013, 15:53:37 Control Specifications: Control 1

Show Elements: All Elements Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DA 1	1.7	121.8	20Dec2012, 12:39	27.7
Upper Pond	1.7	14.0	20Dec2012, 19:43	25.4

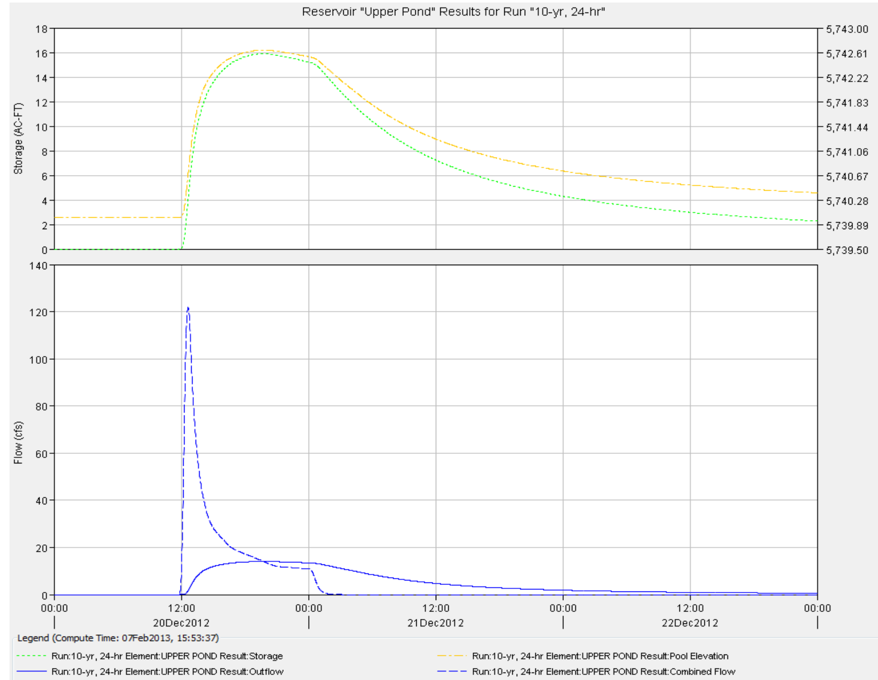
Project: Gay Mine A-12 Pit Diversion
Simulation Run: 10-yr, 24-hr Reservoir: Upper Pond

Start of Run: 20Dec2012, 00:00 Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00 Meteorologic Model: 10-yr, 24-hr
Compute Time: 07Feb2013, 15:53:37 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow :	121.8 (CFS)	Date/Time of Peak Inflow :	20Dec2012, 12:39
Peak Outflow :	14.0 (CFS)	Date/Time of Peak Outflow :	20Dec2012, 19:43
Total Inflow :	27.7 (AC-FT)	Peak Storage :	15.9 (AC-FT)
Total Outflow :	25.4 (AC-FT)	Peak Elevation :	5742.6 (FT)



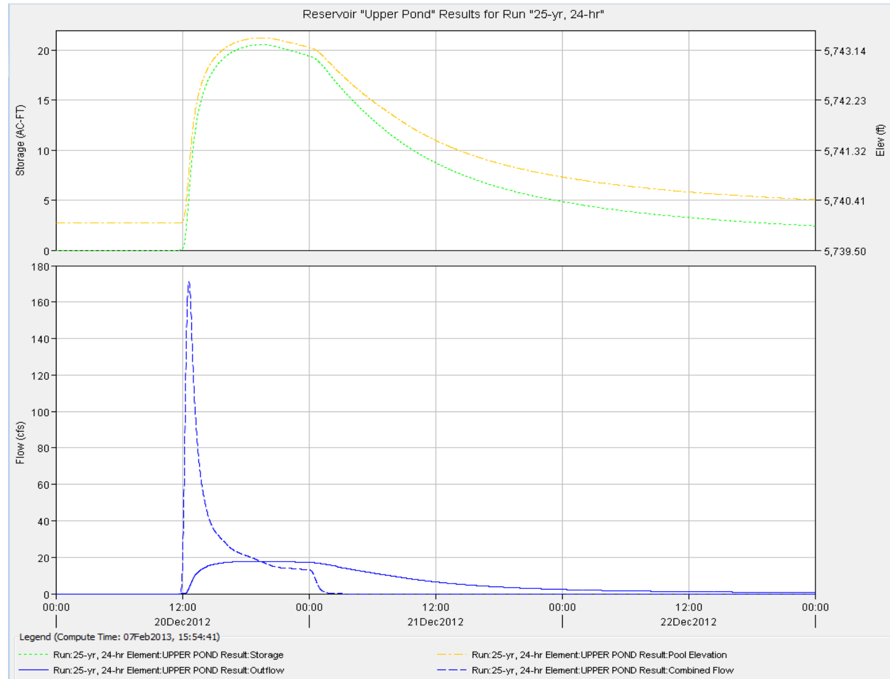
25-yr, 24-hr Storm Event

Project: Gay Mine A-12 Pit Diversion   Simulation Run: 25-yr, 24-hr

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 25-yr, 24-hr
Compute Time: 07Feb2013, 15:54:41   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN AC-FT   Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DA 1	1.7	171.1	20Dec2012, 12:38	35.7
Upper Pond	1.7	17.7	20Dec2012, 19:20	33.3



Project: Gay Mine A-12 Pit Diversion
Simulation Run: 25-yr, 24-hr   Reservoir: Upper Pond

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 25-yr, 24-hr
Compute Time: 07Feb2013, 15:54:41   Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow :	171.1 (CFS)	Date/Time of Peak Inflow :	20Dec2012, 12:38
Peak Outflow :	17.7 (CFS)	Date/Time of Peak Outflow :	20Dec2012, 19:20
Total Inflow :	35.7 (AC-FT)	Peak Storage :	20.6 (AC-FT)
Total Outflow :	33.3 (AC-FT)	Peak Elevation :	5743.4 (FT)

50-yr, 24-hr Storm Event

Project: Gay Mine A-12 Pit Diversion   Simulation Run: 50-yr, 24-hr

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 50-yr, 24-hr
Compute Time: 07Feb2013, 15:57:12   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN AC-FT   Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DA 1	1.7	288.7	20Dec2012, 12:36	53.7
Upper Pond	1.7	18.2	20Dec2012, 23:03	50.5

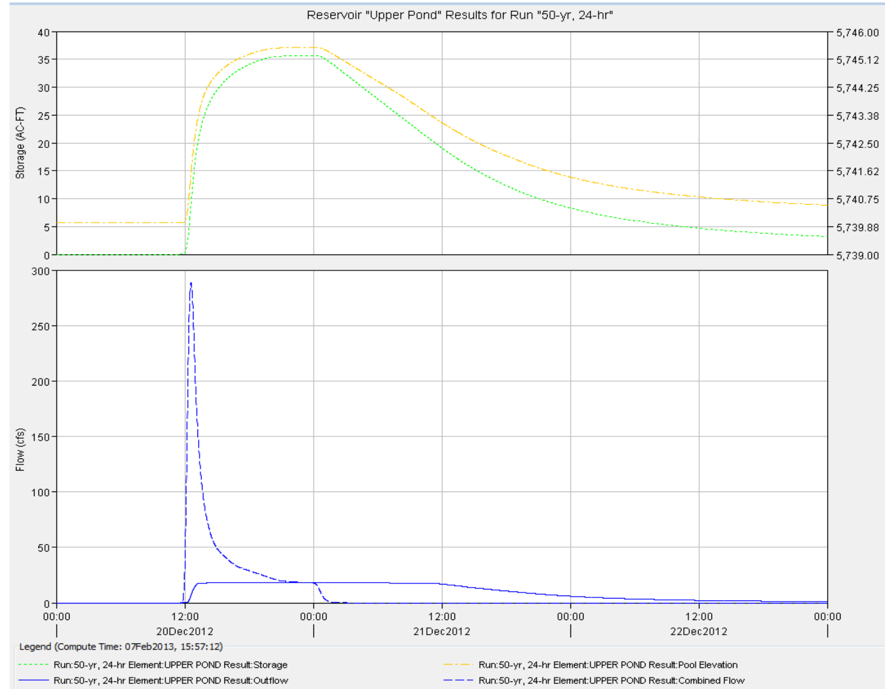
Project: Gay Mine A-12 Pit Diversion
Simulation Run: 50-yr, 24-hr   Reservoir: Upper Pond

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 50-yr, 24-hr
Compute Time: 07Feb2013, 15:57:12   Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow :	288.7 (CFS)	Date/Time of Peak Inflow :	20Dec2012, 12:36
Peak Outflow :	18.2 (CFS)	Date/Time of Peak Outflow :	20Dec2012, 23:03
Total Inflow :	53.7 (AC-FT)	Peak Storage :	35.7 (AC-FT)
Total Outflow :	50.5 (AC-FT)	Peak Elevation :	5745.5 (FT)



100-yr, 24-hr Storm Event

Project: Gay Mine A-12 Pit Diversion Simulation Run: 100-yr, 24-hr

Start of Run: 20Dec2012, 00:00 Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00 Meteorologic Model: 100-yr, 24-hr
Compute Time: 07Feb2013, 15:58:46 Control Specifications: Control 1

Show Elements: All Elements Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DA 1	1.7	394.3	20Dec2012, 12:35	69.3
Upper Pond	1.7	18.6	21Dec2012, 00:20	65.0

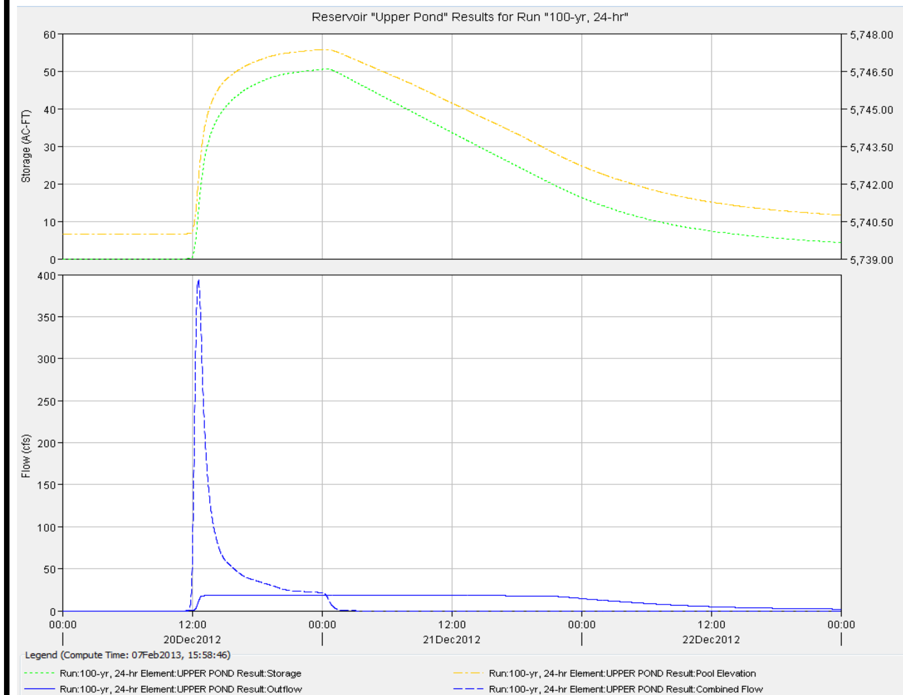
Project: Gay Mine A-12 Pit Diversion
Simulation Run: 100-yr, 24-hr Reservoir: Upper Pond

Start of Run: 20Dec2012, 00:00 Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00 Meteorologic Model: 100-yr, 24-hr
Compute Time: 07Feb2013, 15:58:46 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow : 394.3 (CFS) Date/Time of Peak Inflow : 20Dec2012, 12:35
Peak Outflow : 18.6 (CFS) Date/Time of Peak Outflow : 21Dec2012, 00:20
Total Inflow : 69.3 (AC-FT) Peak Storage : 50.5 (AC-FT)
Total Outflow : 65.0 (AC-FT) Peak Elevation : 5747.4 (FT)



North Alignment, 1.5-ft diameter pipeline
2-yr, 24-hr Storm Event

Project: Gay Mine A-12 Pit Diversion   Simulation Run: 2-yr, 24-hr

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 2-yr, 24-hr
Compute Time: 07Feb2013, 16:03:53   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN AC-FT   Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DA 1	1.7	14.5	20Dec2012, 12:57	7.0
Upper Pond	1.7	2.7	21Dec2012, 00:33	5.3

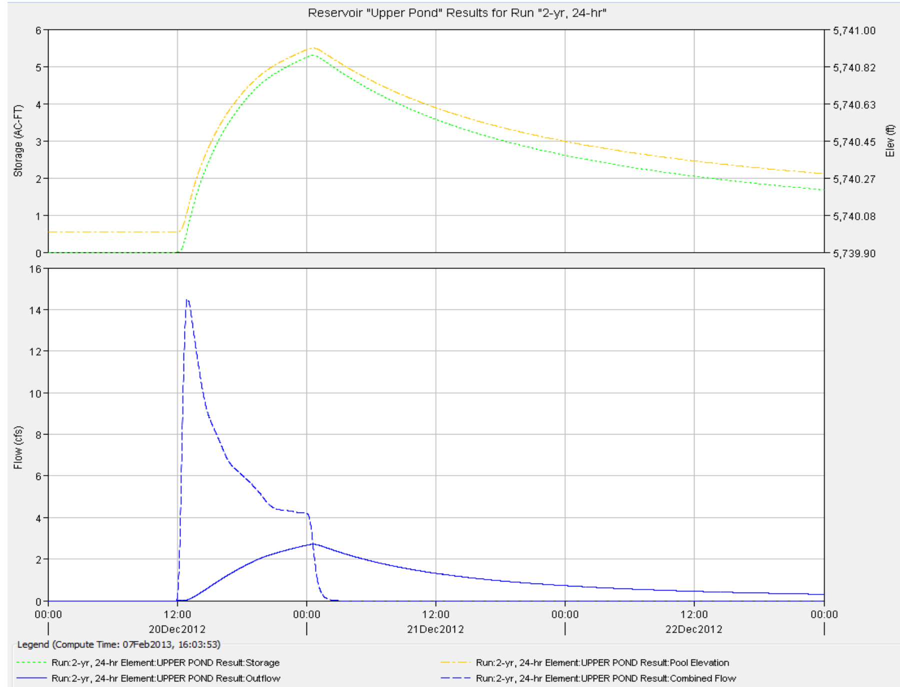
Project: Gay Mine A-12 Pit Diversion
Simulation Run: 2-yr, 24-hr   Reservoir: Upper Pond

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 2-yr, 24-hr
Compute Time: 07Feb2013, 16:03:53   Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow : 14.5 (CFS)   Date/Time of Peak Inflow : 20Dec2012, 12:57
Peak Outflow : 2.7 (CFS)   Date/Time of Peak Outflow : 21Dec2012, 00:33
Total Inflow : 7.0 (AC-FT)   Peak Storage : 5.3 (AC-FT)
Total Outflow : 5.3 (AC-FT)   Peak Elevation : 5740.9 (FT)



10-yr, 24-hr Storm Event

Project: Gay Mine A-12 Pit Diversion   Simulation Run: 10-yr, 24-hr

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 10-yr, 24-hr
Compute Time: 07Feb2013, 16:05:59   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN AC-FT   Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DA 1	1.7	121.8	20Dec2012, 12:39	27.7
Upper Pond	1.7	7.0	21Dec2012, 00:30	24.6

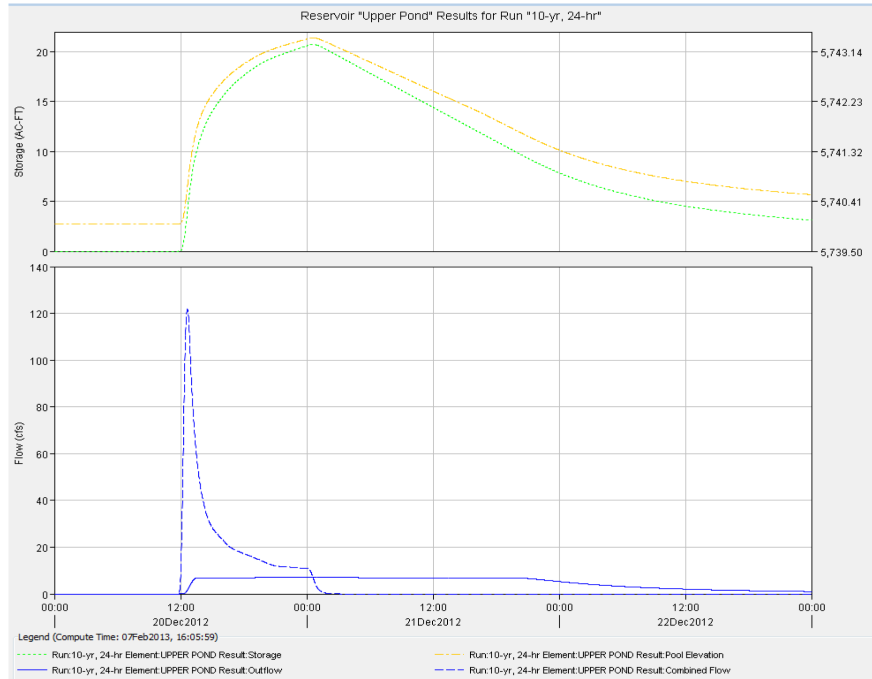
Project: Gay Mine A-12 Pit Diversion
Simulation Run: 10-yr, 24-hr   Reservoir: Upper Pond

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 10-yr, 24-hr
Compute Time: 07Feb2013, 16:05:59   Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow :	121.8 (CFS)	Date/Time of Peak Inflow :	20Dec2012, 12:39
Peak Outflow :	7.0 (CFS)	Date/Time of Peak Outflow :	21Dec2012, 00:30
Total Inflow :	27.7 (AC-FT)	Peak Storage :	20.7 (AC-FT)
Total Outflow :	24.6 (AC-FT)	Peak Elevation :	5743.4 (FT)



25-yr, 24-hr Storm Event

Project: Gay Mine A-12 Pit Diversion Simulation Run: 25-yr, 24-hr

Start of Run: 20Dec2012, 00:00 Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00 Meteorologic Model: 25-yr, 24-hr
Compute Time: 07Feb2013, 16:08:35 Control Specifications: Control 1

Show Elements: All Elements Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DA 1	1.7	171.1	20Dec2012, 12:38	35.7
Upper Pond	1.7	7.3	21Dec2012, 00:38	31.0

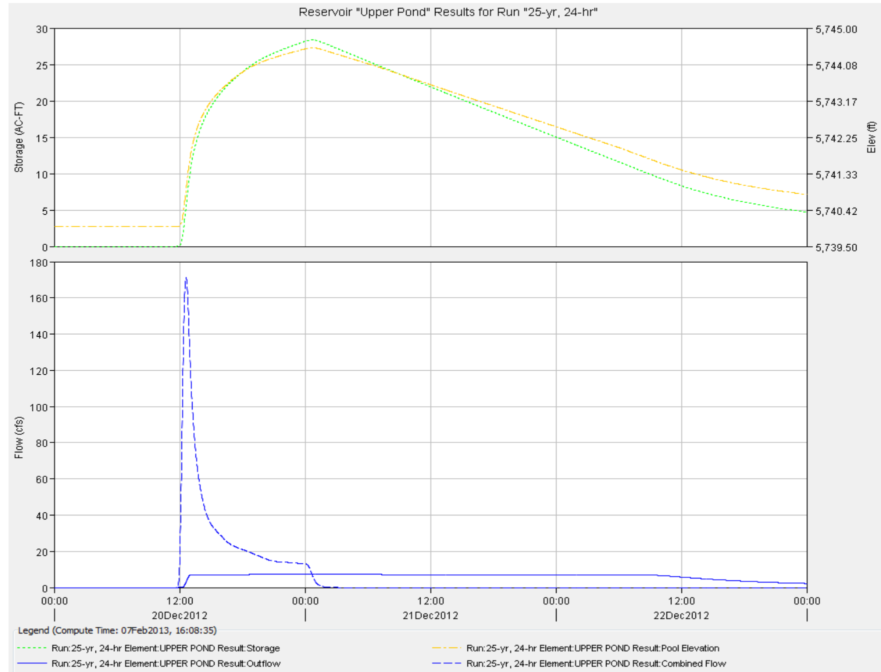
Project: Gay Mine A-12 Pit Diversion
Simulation Run: 25-yr, 24-hr Reservoir: Upper Pond

Start of Run: 20Dec2012, 00:00 Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00 Meteorologic Model: 25-yr, 24-hr
Compute Time: 07Feb2013, 16:08:35 Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow :	171.1 (CFS)	Date/Time of Peak Inflow :	20Dec2012, 12:38
Peak Outflow :	7.3 (CFS)	Date/Time of Peak Outflow :	21Dec2012, 00:38
Total Inflow :	35.7 (AC-FT)	Peak Storage :	28.4 (AC-FT)
Total Outflow :	31.0 (AC-FT)	Peak Elevation :	5744.5 (FT)



50-yr, 24-hr Storm Event

Project: Gay Mine A-12 Pit Diversion   Simulation Run: 50-yr, 24-hr

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 50-yr, 24-hr
Compute Time: 07Feb2013, 16:09:52   Control Specifications: Control 1

Show Elements: All Elements   Volume Units: IN AC-FT   Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
DA 1	1.7	288.7	20Dec2012, 12:36	53.7
Upper Pond	1.7	7.8	21Dec2012, 00:44	36.5

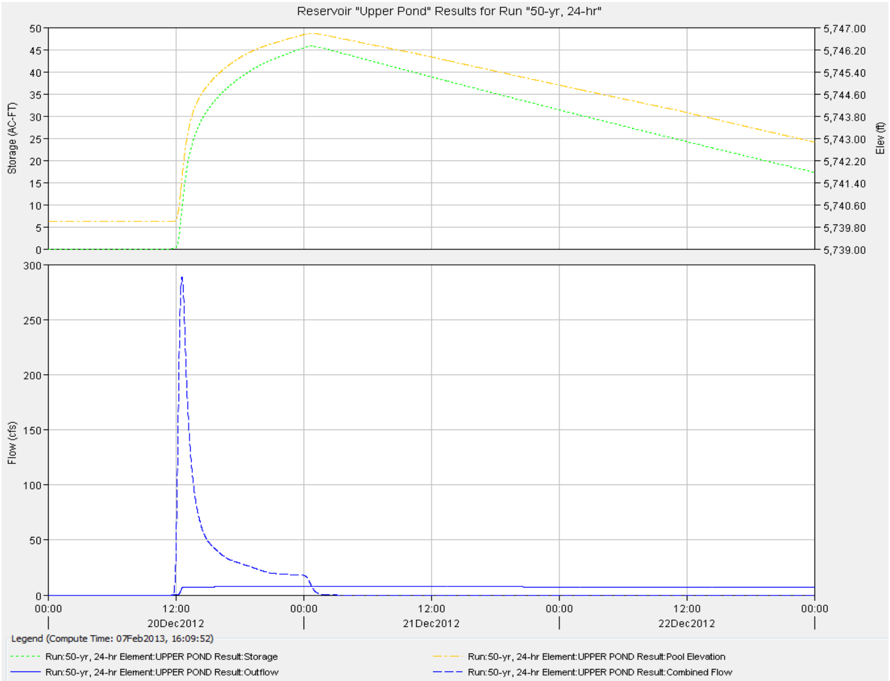
Project: Gay Mine A-12 Pit Diversion
Simulation Run: 50-yr, 24-hr   Reservoir: Upper Pond

Start of Run: 20Dec2012, 00:00   Basin Model: A-12 Pit Area
End of Run: 23Dec2012, 00:00   Meteorologic Model: 50-yr, 24-hr
Compute Time: 07Feb2013, 16:09:52   Control Specifications: Control 1

Volume Units: IN AC-FT

Computed Results

Peak Inflow :	288.7 (CFS)	Date/Time of Peak Inflow :	20Dec2012, 12:36
Peak Outflow :	7.8 (CFS)	Date/Time of Peak Outflow :	21Dec2012, 00:44
Total Inflow :	53.7 (AC-FT)	Peak Storage :	45.8 (AC-FT)
Total Outflow :	36.5 (AC-FT)	Peak Elevation :	5746.8 (FT)



Flowmaster was used to size the ditch along each alignment (north and south) for the peak flow from the 25-year, 24-hour storm event. The velocity at the discharge from the pipeline to the ditch was also checked.

South Alignment

Worksheet : S Ditch Trapezoidal Channel

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Normal Depth   Friction Method: Manning Formula

Roughness Coefficient:	0.069		Flow Area:	6.81	ft²
Channel Slope:	0.01900	ft/ft	Wetted Perimeter:	8.31	ft
Normal Depth:	1.41	ft	Hydraulic Radius:	0.82	ft
Left Side Slope:	2.00	ft/ft (H:V)	Top Width:	7.65	ft
Right Side Slope:	2.00	ft/ft (H:V)	Critical Depth:	0.98	ft
Bottom Width:	2.00	ft	Critical Slope:	0.08837	ft/ft
Discharge:	17.70	ft³/s	Velocity:	2.60	ft/s
			Velocity Head:	0.10	ft
			Specific Energy:	1.52	ft
			Froude Number:	0.49	
			Flow Type:	Subcritical	

Calculation Successful.

Worksheet : Pipe Discharge

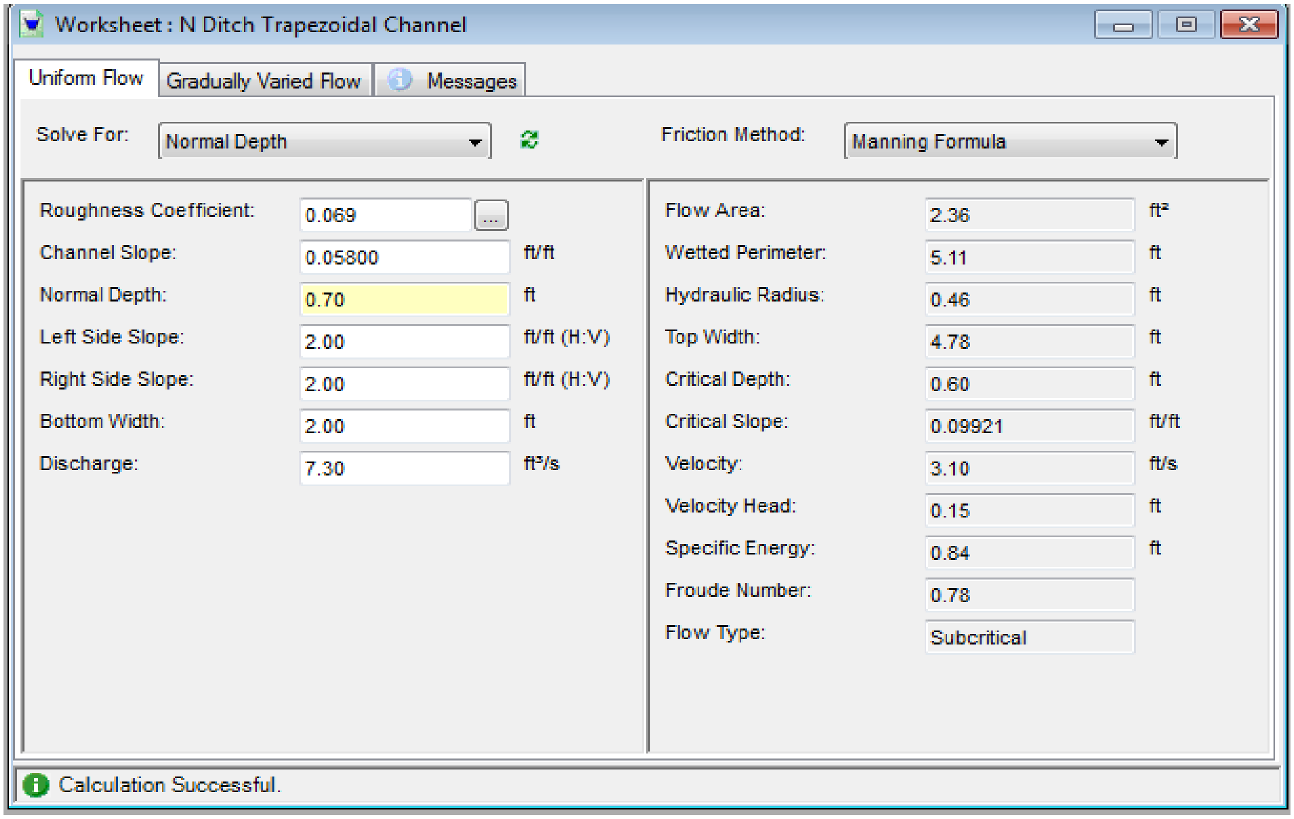
Calculations | Messages

Solve For: Discharge   Friction Method: Manning Formula

Pressure 1:	6.00	feet H2O	Headloss:	42.00	ft
Pressure 2:	0.00	feet H2O	Energy Grade 1:	5747.82	ft
Elevation 1:	5740.00	ft	Energy Grade 2:	5705.82	ft
Elevation 2:	5704.00	ft	Hydraulic Grade 1:	5746.00	ft
Length:	1486.00	ft	Hydraulic Grade 2:	5704.00	ft
Roughness Coefficient:	0.012		Flow Area:	1.77	ft²
Diameter:	1.50	ft	Wetted Perimeter:	4.71	ft
Discharge:	19.13	ft³/s	Velocity:	10.83	ft/s
			Velocity Head:	1.82	ft
			Friction Slope:	0.02826	ft/ft

Calculation Successful.

North Alignment



Worksheet : N Ditch Trapezoidal Channel

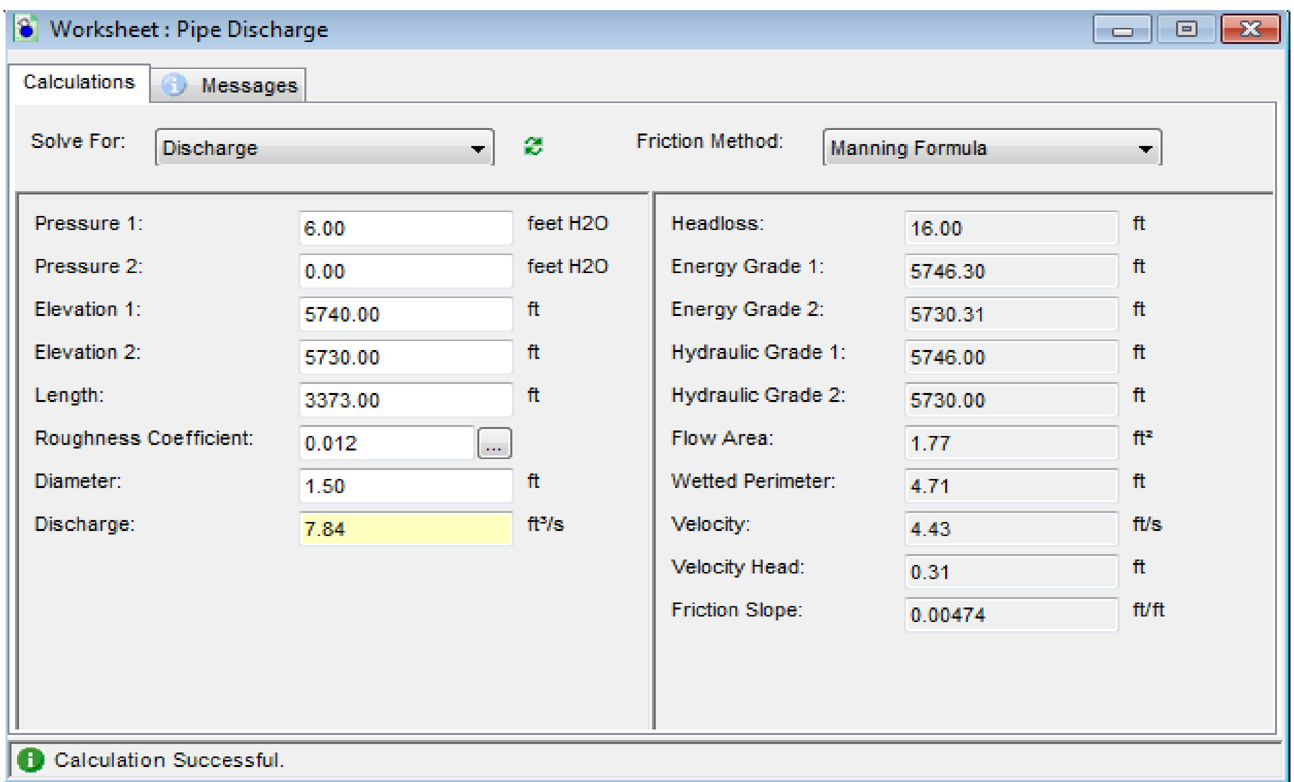
Uniform Flow | Gradually Varied Flow | Messages

Solve For: Normal Depth — Friction Method: Manning Formula

Roughness Coefficient:	0.069	
Channel Slope:	0.05800	ft/ft
Normal Depth:	0.70	ft
Left Side Slope:	2.00	ft/ft (H:V)
Right Side Slope:	2.00	ft/ft (H:V)
Bottom Width:	2.00	ft
Discharge:	7.30	ft³/s

Flow Area:	2.36	ft²
Wetted Perimeter:	5.11	ft
Hydraulic Radius:	0.46	ft
Top Width:	4.78	ft
Critical Depth:	0.60	ft
Critical Slope:	0.09921	ft/ft
Velocity:	3.10	ft/s
Velocity Head:	0.15	ft
Specific Energy:	0.84	ft
Froude Number:	0.78	
Flow Type:	Subcritical	

Calculation Successful.



Worksheet : Pipe Discharge

Calculations | Messages

Solve For: Discharge — Friction Method: Manning Formula

Pressure 1:	6.00	feet H2O
Pressure 2:	0.00	feet H2O
Elevation 1:	5740.00	ft
Elevation 2:	5730.00	ft
Length:	3373.00	ft
Roughness Coefficient:	0.012	
Diameter:	1.50	ft
Discharge:	7.84	ft³/s

Headloss:	16.00	ft
Energy Grade 1:	5746.30	ft
Energy Grade 2:	5730.31	ft
Hydraulic Grade 1:	5746.00	ft
Hydraulic Grade 2:	5730.00	ft
Flow Area:	1.77	ft²
Wetted Perimeter:	4.71	ft
Velocity:	4.43	ft/s
Velocity Head:	0.31	ft
Friction Slope:	0.00474	ft/ft

Calculation Successful.

Time of Concentration (Tc) - Upper Pond Drainage Basin

The sum of the travel times for sheet flow, shallow concentrated flow and channel flow.

1 *Sheet Flow*

T_{sheet} (minutes) =[$0.42(n_s L)^{0.8}$]/[$(P_2)^{0.527}$*$S^{0.4}$]

Where:

n_s =	*Sheet flow Manning's n*
L =	*flow length (ft) up to 300 feet*
P_2 =	*2-year, 24-hour rainfall (in.)*
S =	*Slope of hydraulic grade line (land slope), ft/ft*

Site Data:

n_s =	0.13	Range, natural
L =	300	feet
P_2 =	1.42	From NOAA Atlas 2
S =	0.073	sheet flow slope, ft/ft
T_{sheet} =	**18.61**	**minutes**

2 ***Shallow Concentrated Flow:***

$T_{shallow}$ = Length of flow/V

V = $k_s(s)^{0.5}$

Where:

V =	*Velocity (ft/s)*
k_s =	*time of concentration velocity factor (ft/s)*
s =	*slope of flow path (ft/ft)*

Site Data:

k_s =	13	Nearly bare ground
s =	0.101	ft/ft
V =	4.12	ft/s
Length of flow path =	2566	ft
Time of flow =	**10.37**	**minutes**

3 *Open Channel Flow*

Same equation as above, with different k value

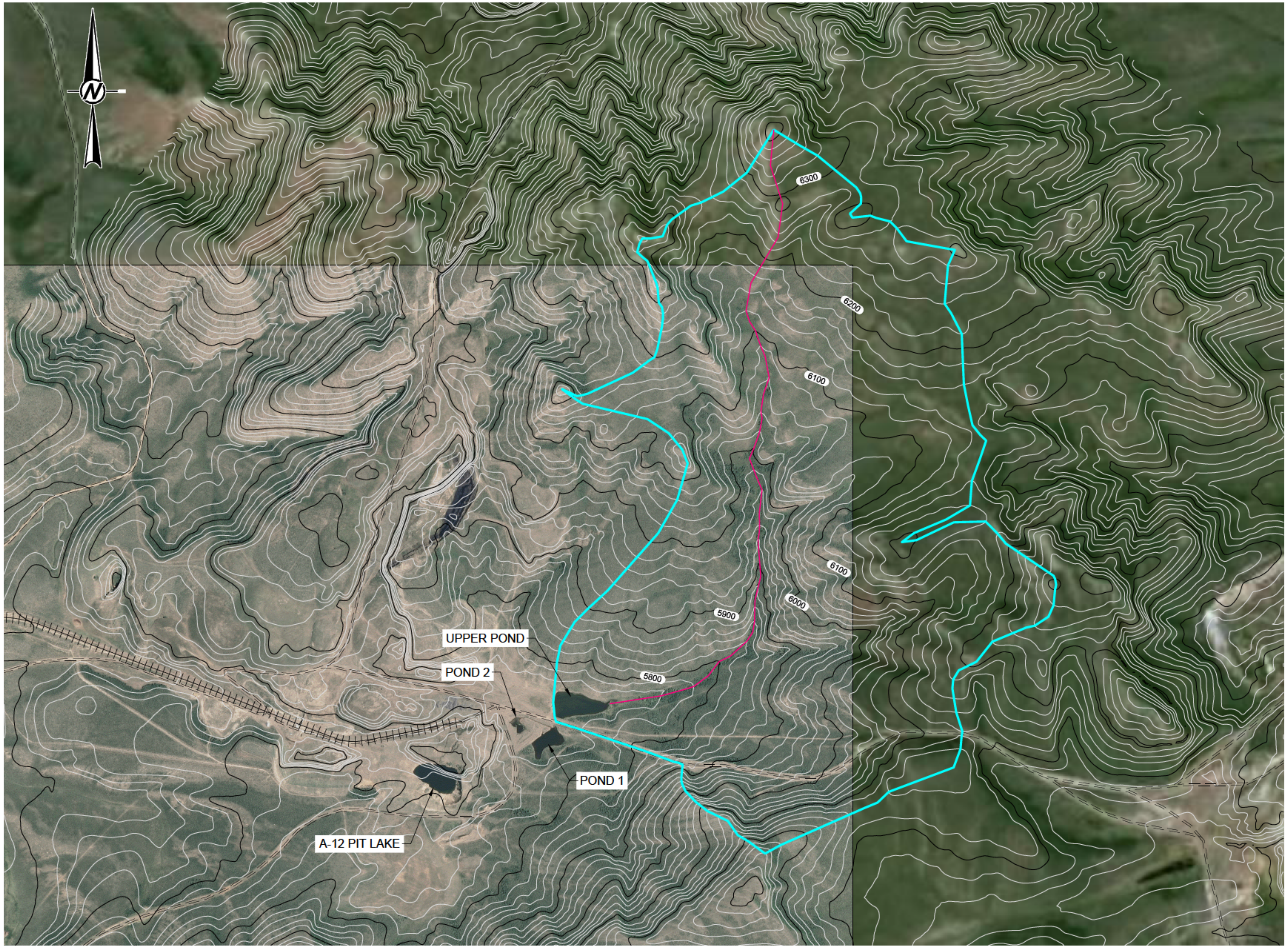
k_c =	17	Grassed waterway
s =	0.049	ft/ft
V =	3.78	ft/s
L =	7500	ft
Time of flow =	**33.10**	**minutes**

Time of Concentration for Basin:

1	T_{sheet}	18.61	minutes
2	$T_{shallow}$	10.37	minutes
3	$T_{channel}$	33.10	minutes
	TOTAL Tc	**62**	**minutes**

Upper Pond Drainage Basin

Segment	Length	Elevation	Delta	Slope		Description
Start		6400		x/y	degree	
1	300	6378	22	0.073	4.2	Sheet Flow
2	2566	6120	258	0.101	5.7	Shallow Concentrated Flow
3	7500	5750	370	0.049	2.8	Open Channel Flow



LEGEND

DRAINAGE AREA

Tc LENGTH

ROAD

RAILROAD

NOTES

HORIZONTAL DATUM: NAD 83 IDAHO STATE PLANE, EAST ZONE, US FOOT

VERTICAL DATUM: NAVD 88, FEET

AERIAL: USDA-NAIP IMAGERY, 2009

TOPOGRAPHY: GOLDER GIS, 11-22-2011

DRAFT

0 800 1600

1" = 1600' FEET

CLIENT	FMC/SIMPLOT
PROJECT	GAY MINE A-12 PIT SURFACE WATER DIVERSION WORK PLAN
CONSULTANT	GOLDER
YYYY-MM-DD	2020-01-27
DESIGNED	VMN
PREPARED	VMN
REVIEWED	FSS
APPROVED	JC
TITLE	**DRAINAGE AREA**
PROJECT NO.	1039341816
PHASE	900
REV.	A
FIGURE	A

Precipitation Frequency Data Output

NOAA Atlas 2
Idaho 43.06°N 112.09°W
Site-specific Estimates

Map	Precipitation (inches)	Precipitation Intensity (in/hr)
2-year 6-hour	0.91	0.15
2-year 24-hour	1.42	0.06
100-year 6-hour	2.01	0.34
100-year 24-hour	3.01	0.13

Go to PFDS
Go to NA2
Hydrometeorological Design Studies Center - NOAA/National Weather Service
1325 East-West Highway - Silver Spring, MD 20910 - (301) 713-1669
Thu Feb 7 16:39:06 2013

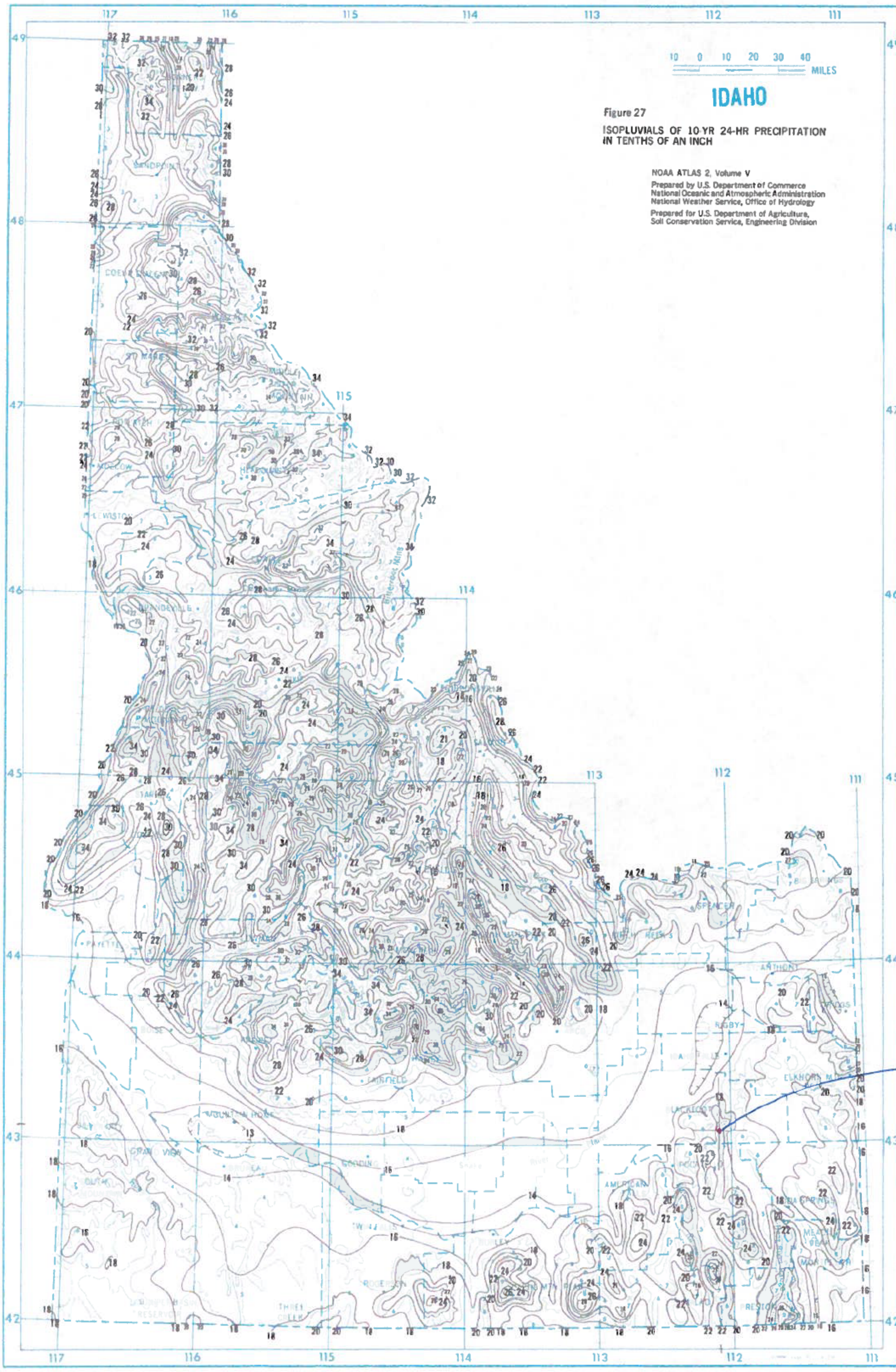
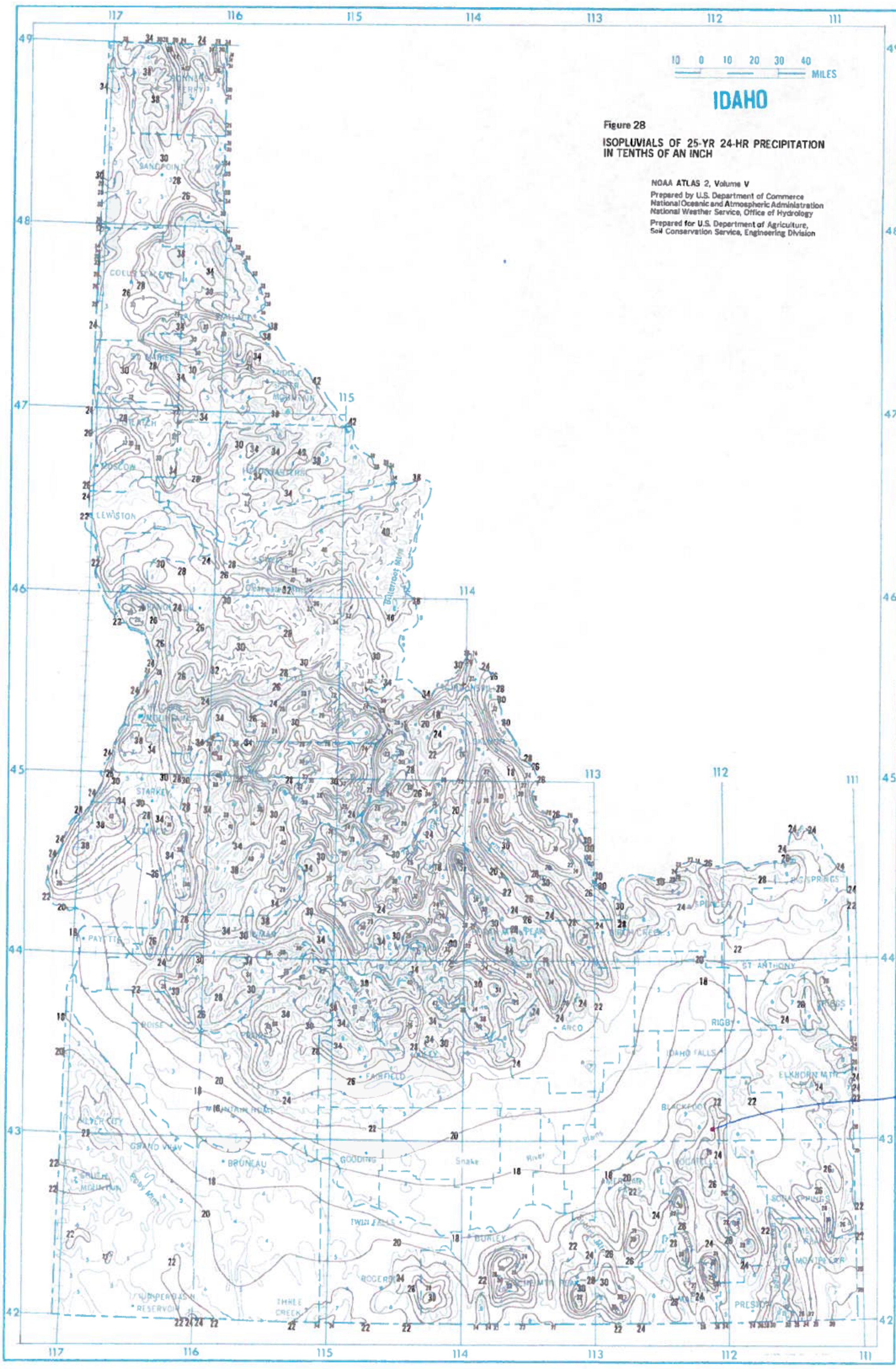


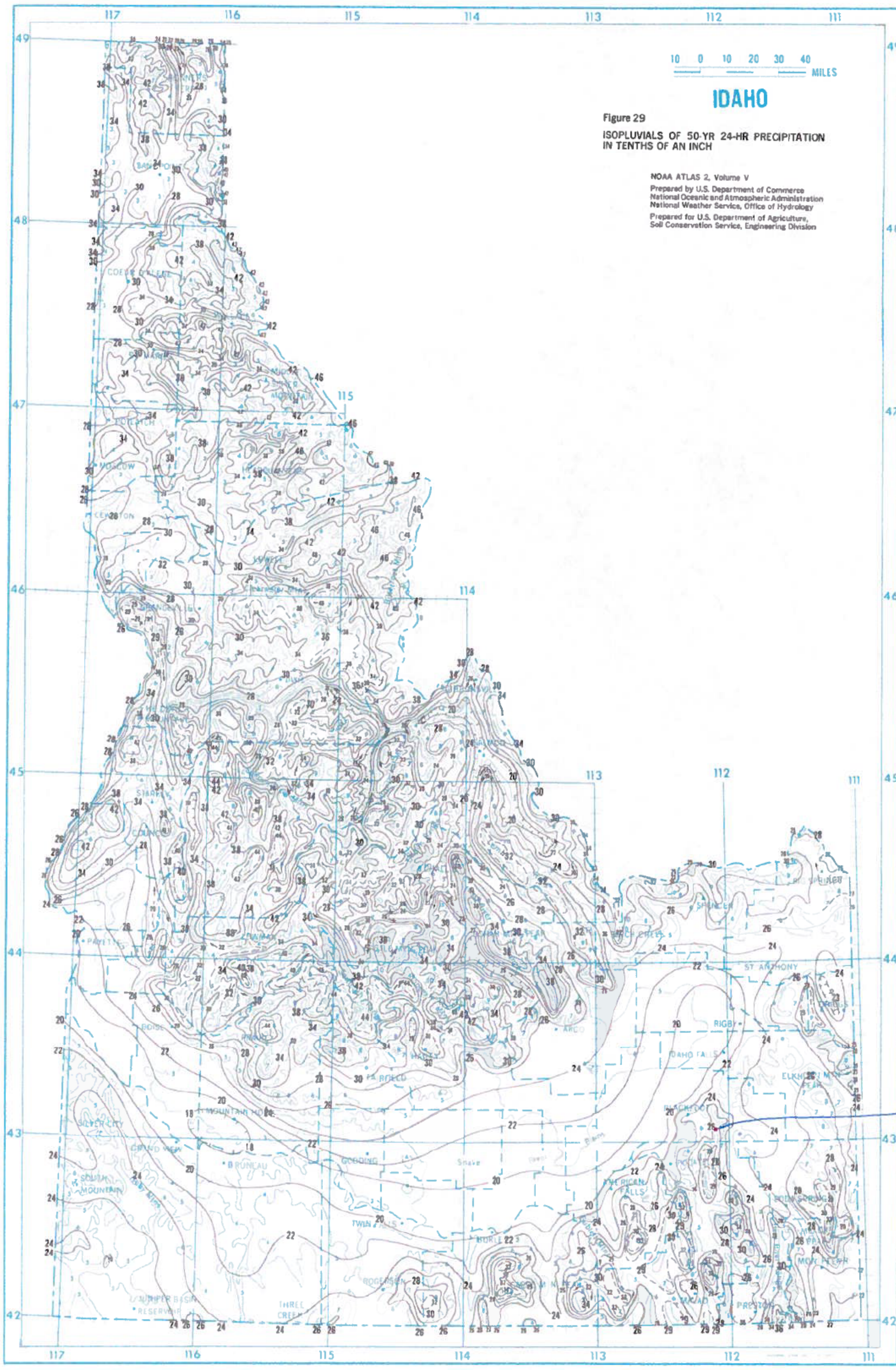
Figure 27

ISOPLUVIALS OF 10-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

Site Location

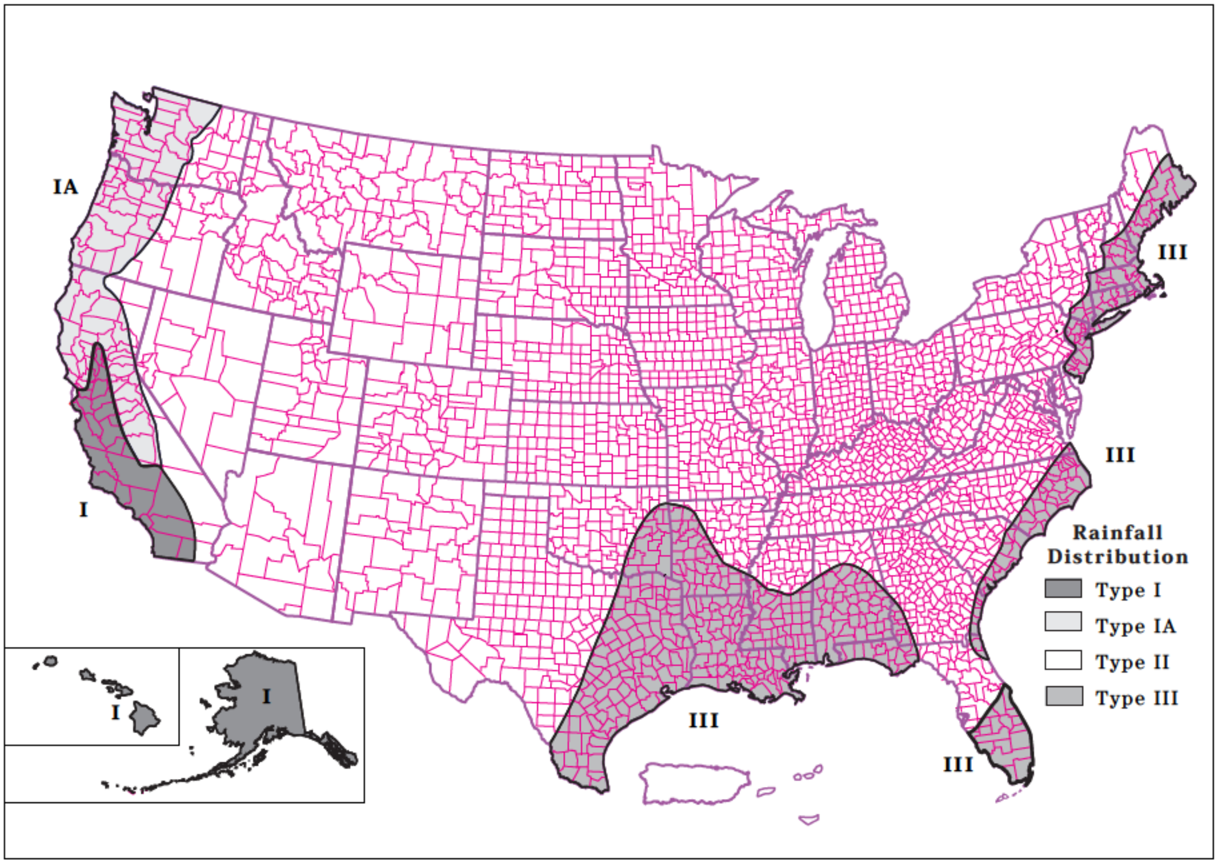


Site Location



Site Location

Figure B 2 Approximate geographic boundaries for NRCS (SCS) rainfall distributions



Rainfall data sources

This section lists the most current 24-hour rainfall data published by the National Weather Service (NWS) for various parts of the country. Because NWS Technical Paper 40 (TP-40) is out of print, the 24-hour rainfall maps for areas east of the 105th meridian are included here as figures B-3 through B-8. For the area generally west of the 105th meridian, TP-40 has been superseded by NOAA Atlas 2, the Precipitation-Frequency Atlas of the Western United States, published by the National Ocean and Atmospheric Administration.

East of 105th meridian

Hershfield, D.M. 1961. Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 40. Washington, DC. 155 p.

West of 105th meridian

Miller, J.F., R.H. Frederick, and R.J. Tracey. 1973. Precipitation-frequency atlas of the Western United States. Vol. I Montana; Vol. II, Wyoming; Vol III, Colorado; Vol. IV, New Mexico; Vol V, Idaho; Vol. VI, Utah; Vol. VII, Nevada; Vol. VIII, Arizona; Vol. IX, Washington; Vol. X, Oregon; Vol. XI, California. U.S. Dept. of Commerce, National Weather Service, NOAA Atlas 2. Silver Spring, MD.

Alaska

Miller, John F. 1963. Probable maximum precipitation and rainfall-frequency data for Alaska for areas to 400 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. of Commerce, Weather Bur. Tech. Pap. No. 47. Washington, DC. 69 p.

Hawaii

Weather Bureau. 1962. Rainfall-frequency atlas of the Hawaiian Islands for areas to 200 square miles, durations to 24 hours and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 43. Washington, DC. 60 p.

Puerto Rico and Virgin Islands

Weather Bureau. 1961. Generalized estimates of probable maximum precipitation and rainfall-frequency data for Puerto Rico and Virgin Islands for areas to 400 square miles, durations to 24 hours, and return periods from 1 to 100 years. U.S. Dept. Commerce, Weather Bur. Tech. Pap. No. 42. Washington, DC. 94 P.

APPENDIX C

Cost Estimate Information

Quantities

Item	Quantity	Units	Source	Assumptions / Comments
Clear and Grub Area				
North Alignment	4.2	acres		Surface area of pipeline trench and ditch excavations
South Alignment	3.9	acres		Surface area of pipeline trench and ditch excavations
North Alignment Pipeline				
Length of pipeline	3,372	lf	North Alignment dwg	
Surface area of pipeline trench excavation	104,325	sf	North Alignment dwg	Civil 3D corridor surface
Volume of pipeline trench excavation	16,663	bcy	North Alignment dwg	Civil 3D corridor volume; trapezoidal trench, 3.5' bottom width, 1H:1V side slopes
Volume of bedding sand	1,535	lcy	See "Derived Quantities" table	
Volume of native soil trench backfill (loose)	16,552	lcy	See "Derived Quantities" table	
Volume of native soil trench backfill (bank)	15,048	bcy	See "Derived Quantities" table	
North Alignment Ditch				
Length of ditch	1,213	lf	North Alignment dwg	
Surface area of ditch excavation	13,275	sf	See "Derived Quantities" table	
Volume of ditch excavation	539	bcy	See "Derived Quantities" table	
Quantity of geotextile	1,475	sy	See "Derived Quantities" table	
Volume of 3" rock	246	cy	See "Derived Quantities" table	
Outlet Protection at Pipeline Discharge				
Volume of riprap	3	cy	See "Derived Quantities" table	
South Alignment Pipeline				
Length of pipeline	1,486	lf	South Alignment dwg	
Surface area of pipeline trench excavation	75,325	sf	South Alignment dwg	Civil 3D corridor surface
Volume of pipeline trench excavation	19,498	bcy	South Alignment dwg	Civil 3D corridor volume; trapezoidal trench,4.5' bottom width, 1H:1V side slopes
Volume of bedding sand	676	lcy	See "Derived Quantities" table	
Volume of native soil trench backfill (loose)	20,665	lcy	See "Derived Quantities" table	
Volume of native soil trench backfill (bank)	18,786	bcy	See "Derived Quantities" table	

Quantities

Item	Quantity	Units	Source	Assumptions / Comments
South Alignment Ditch				
Length of ditch	2,264	lf	South Alignment dwg	
Surface area of ditch excavation	29,840	sf	See "Derived Quantities" table	
Volume of ditch excavation	734	bcy	See "Derived Quantities" table	
Quantity of geotextile	3,316	sy	See "Derived Quantities" table	
Volume of 3" rock	553	cy	See "Derived Quantities" table	
Energy Dissipation Structure at Pipeline				
Volume of riprap	9	cy	See "Derived Quantities" table	
Extended Ditch				
Length of lined portion of ditch	200	lf	Extended Ditch dwg	
Surface area of ditch excavation	2,189	sf	See "Derived Quantities" table	
Volume of ditch excavation	44	bcy	See "Derived Quantities" table	
Quantity of SmartDitch HDPE lining	243	sy	See "Derived Quantities" table	
Length of unlined portion of ditch	5,738	lf	Extended Ditch dwg	
Surface area of ditch excavation	62,798	sf	See "Derived Quantities" table	
Volume of ditch excavation	1,275	bcy	See "Derived Quantities" table	
Additional Rock for Swale Across Road				
Volume of 3" rock	111	cy	See "Derived Quantities" table	
Seeding Area				
North Alignment	4.6	acres		Surface area of pipeline trench excavation, plus 50% for work areas, plus 1 acre for laydown/staging area
South Alignment	3.6	acres		Surface area of pipeline trench excavation, plus 50% for work areas, plus 1 acre for laydown/staging area

Abbreviations:

cy = cubic yard
bcy = bank cubic yard
lcy = loose cubic yard
lf = linear foot
ls = lump sum
mo = month
sf = square foot
sy = square yard

Derived Quantities

North Alignment Pipeline

1.5' diameter pipe, underlain by 3" bedding sand, overlain by 6" bedding sand, backfilled with native soil

Trapezoidal trench with 27" min depth, 3.5' bottom width, 1H:1V side slopes

Total volume of pipeline trench excavation =	16,663	bcy		
Depth to top of bedding sand =	2.25	ft		
Trench sideslope =	1	H:1V		
Bottom width =	3.5	ft		
Length of pipeline =	3,372	lf		
Diameter of pipeline =	1.5	ft		
Volume occupied by bedding sand and pipeline =			43,625	cf
			1,616	bcy
Volume of bedding sand =			37,669	cf
			1,395	bcy
			1,535	lcy
Volume of native soil trench backfill =			15,048	bcy
			16,552	lcy

Ditch

Trapezoidal ditch with 1.5' depth, 2' bottom width, 2H:1V side slopes (8' top width)

Lined with geotextile, overlain by 6" layer of 3" rock (average size)

Ditch depth =	2	ft	includes 6 inches to allow for rock layer	
Ditch sideslope =	2	H:1V		
Bottom width =	2	ft		
Length of ditch =	1,213	lf		
Total ditch surface area =			13,275	sf
			1,475	sy
Total ditch excavation volume =			539	bcy
Thickness of 3" rock =	0.5	ft		
Volume of 3" rock =			6,638	cf
			246	cy

Outlet Protection at Pipeline Discharge

Riprap-lined basin

Thickness of riprap =	1	ft

Derived Quantities

Width of riprap =	8 ft	
Length of riprap =	10 ft	
Volume of riprap =		80 cf
		3 cy

Derived Quantities

South Alignment Pipeline

1.5' diameter pipe, underlain by 3" bedding sand, overlain by 6" bedding sand, backfilled with native soil

Trapezoidal trench with 27" min depth, 3.5' bottom width, 1H:1V side slopes

Total volume of pipeline trench excavation =	19,498	bcy			
Depth to top of bedding sand =	2.25	ft			
Trench sideslope =	1	H:1V			
Bottom width =	3.5	ft			
Length of pipeline =	1,486	lf			
Diameter of pipeline =	1.5	ft			
Volume occupied by bedding sand and pipeline =			19,225	cf	
			712	bcy	
Volume of bedding sand =			16,600	cf	
			615	bcy	
			676	lcy	
Volume of native soil trench backfill =			18,786	bcy	
			20,665	lcy	

Ditch

Trapezoidal ditch with 2' depth, 2' bottom width, 2H:1V side slopes (10' top width)

Lined with geotextile, overlain by 6" layer of 3" rock (average size)

Ditch depth =	2.5	ft	includes 6 inches to allow for rock layer		
Ditch sideslope =	2	H:1V			
Bottom width =	2	ft			
Length of ditch =	2,264	lf			
Total ditch surface area =			29,840	sf	
			3,316	sy	
Total ditch excavation volume =			734	bcy	includes 50% reduced excavation assumed due to existing ditch
Thickness of 3" rock =	0.5	ft			
Volume of 3" rock =			14,920	cf	
			553	cy	

Energy Dissipation Structure at Pipeline Discharge

Riprap-lined basin

Thickness of riprap =	2	ft
Width of riprap =	10	ft
Length of riprap =	12	ft

Derived Quantities

Volume of riprap =		240 cf	
		9 cy	

Extended Ditch (SmartDitch Lined Portion)

Trapezoidal ditch with 2' depth, 2' bottom width, 2H:1V side slopes (10' top width)
Lined with HDPE drainage lining system (e.g., SmartDitch)

Ditch depth =	2 ft		
Ditch sideslope =	2 H:1V		
Bottom width =	2 ft		
Length of lined portion of ditch =	200 lf		
Total ditch surface area =		2,189 sf	
		243 sy	
Total ditch excavation volume =		44 bcy	includes 50% reduced excavation assumed due to existing ditch

Extended Ditch (Unlined Portion)

Trapezoidal ditch with 2' depth, 2' bottom width, 2H:1V side slopes (10' top width)

Ditch depth =	2 ft		
Ditch sideslope =	2 H:1V		
Bottom width =	2 ft		
Length of unlined portion of ditch =	5,738 lf		
Total ditch surface area =		62,798 sf	
		6,978 sy	
Total ditch excavation volume =		1,275 bcy	includes 50% reduced excavation assumed due to existing ditch

Additional Rock for Swale Across Road

12" additional thickness of 3" rock (average size) in broad swale

Additional thickness of 3" rock =	1 ft	
Area of road crossing =	3000 sf	
Volume of additional 3" rock =		3,000 cf
		111 cy

Abbreviations:

- cf = cubic foot
- cy = cubic yard
- bcy = bank cubic yard
- lcy = loose cubic yard
- lf = linear foot
- sf = square foot
- sy = square yard

Unit Costs

Item	Unit Cost	Units	Source / Comments
Mob/demob heavy equipment	$10,000	ls	Estimate
Temporary facili ies	$5,000	mo	Estimate
Improve access areas, site cleanup, and other site preparation	$10,000	ls	Estimate
Clear and grub	$1,300	acre	Means 31 13 13.10 0300, clearing brush with dozer, light
Excavate trench	$2.62	bcy	Means 31 23 16.13 1030, excavating trench, common earth, 10' to 14' deep, 3-cy excavator
Place pipeline bedding sand from stockpile	$9.95	lcy	Means 31 23 16.13 3100, backfill trench, front-end loader, 2 1/4-cy bucket, 200' haul
Pipeline bedding sand, stockpiled on-site	$50	lcy	Estimate
Pipeline (incl material) in-place	$69.00	lf	Means 33 11 13.35 0800, HDPE, 18" diameter
Place native soil backfill located adjacent to trench	$2.49	lcy	Means 31 23 16.13 3080, backfill trench, front-end loader, 2 1/4-cy bucket, minimum haul
Compact material in trench/ditch	$1.00	bcy	Estimate, with excavator bucket
Excavate ditch	$5.05	bcy	Means 31 23 16.13 0120, excavating trench, common earth, 4' to 6' deep, 1-cy excavator
Place geotextile (incl material)	$2.14	sy	Means 33 41 23.19 0100, fabric laid in trench, polypropylene
Place rock from stockpile	$9.95	lcy	Means 31 23 16.13 3100, backfill trench, front-end loader, 2 1/4-cy bucket, 200' haul
3" rock (average size), stockpiled on-site	$60	cy	Estimate
Riprap, stockpiled on-site	$75	cy	Estimate
Earthwork for unlined portion of extended ditch	$10	lf	Estimate
Install SmartDitch (incl material)	$25.20	lf	Per Jeff Hamilton, Simplot
Seed disturbed areas	$2,134	acre	Means 32 92 19.14 1700, hydro or air seeding with mulch and fertilizer, converted to acres
Design	$ 80,000	ls	Estimate
Construction oversight	$ 30,000	mo	Estimate
Construction summary report	$ 15,000	ls	Estimate
Site inspection	$ 1,000	yr	Estimate
Site maintenance	$ 2,000	yr	Estimate

Notes:
a. Unit costs were taken mainly from RS Means Heavy Construction Cost Data 2019 (Means).

Derived Unit Costs

North and South Alignments

Install Pipeline

1.5' diameter pipe, underlain by 3" bedding sand, overlain by 6" bedding sand, backfilled with native soil
Trapezoidal trench with 27" min depth, 4.5' bottom width, 1H:1V side slopes

Depth to top of bedding sand =	2.25 ft		
Trench sideslope =	1 H:1V		
Bottom width =	3.5 ft		
Diameter of pipeline =	1.5 ft		
Volume occupied by bedding sand and pipeline per lf =			12.94 cf/lf
			0.48 bcy/lf
Volume of bedding sand per lf =			11.17 cf/lf
			0.41 bcy/lf
			0.46 lcy/lf

Bedding sand placement unit cost =	$ 9.95 per lcy	
Bedding sand compaction unit cost =	$ 1.00 per bcy	
Bedding sand material unit cost =	$ 50.00 per lcy	
Bedding sand cost =		$ 27.70 per lf
Pipeline placement cost =		$ 69.00 per lf
Total pipeline installation unit cost =		$ 96.70 per lf

North Alignment

Excavate Trench for Pipeline

Volume of pipeline trench excavation =	16,663 bcy	
Length of pipeline =	3,372 lf	
Excavation volume per lf =		4.94 bcy/lf
Excavation unit cost =	$ 2.62 per bcy	
Excavation cost =		$ 12.95 per lf

Excavate and Install Ditch

Trapezoidal ditch with 1.5' depth, 2' bottom width, 2H:1V side slopes (8' top width)
Lined with geotextile, overlain by 6" layer of 3" rock (average size)

Ditch depth =	2 ft		includes 6 inches to allow for rock layer
Ditch sideslope =	2 H:1V		
Bottom width =	2 ft		
Ditch surface area per lf =		10.94 sf/lf	
Ditch surface area per lf =		1.22 sy/lf	
Ditch volume per lf =		0.44 bcy/lf	

Excavation unit cost =	$ 5.05 per bcy	
Excavation cost =		$ 2.24 per lf
Subgrade compaction unit cost =	$ 1.00 per bcy	
Compaction cost =		$ 0.44 per lf
Geotextile placement unit cost =	$ 2.14 per sy	
Geotextile cost =		$ 2.60 per lf
3" rock layer thickness =	0.5 ft	
3" rock volume =		0.20 cy/lf
3" rock layer placement unit cost =	$ 9.95 per cy	
3" rock layer material unit cost =	$ 60.00 per cy	
3" rock layer cost =		$ 14.18 per lf
Total ditch excavation and installation unit cost =		$ 19.47 per lf

South Alignment

Excavate Trench for Pipeline

Volume of pipeline trench excavation =	19,498	bcy		
Length of pipeline =	1,486	lf		
Excavation volume per lf =			13.12	bcy/lf
Excavation unit cost =	$ 2.62	per bcy		
Excavation cost =			$ 34.38	per lf

Excavate and Install Ditch

Trapezoidal ditch, 2' depth, 2' bottom width, 2H:1V side slopes (10' top width)
Lined with geotextile, overlain by 6" layer of 3" rock (average size)

Ditch depth =	2.5	ft			includes 6 inches to allow for rock layer
Ditch sideslope =	2	H:1V			
Bottom width =	2	ft			
Ditch surface area per lf =			13.18	sf/lf	
Ditch surface area per lf =			1.46	sy/lf	
Ditch volume per lf =			0.65	bcy/lf	
Excavation unit cost =	$ 5.05	per bcy			
Excavation cost =			$ 1.64	per lf	includes 50% reduced excavation assumed due to existing ditch
Subgrade compaction unit cost =	$ 1.00	per bcy			
Compaction cost =			$ 0.65	per lf	
Geotextile placement unit cost =	$ 2.14	per sy			
Geotextile cost =			$ 3.13	per lf	
3" rock layer thickness =	0.5	ft			
3" rock volume =			0.24	cy/lf	
3" rock layer placement unit cost =	$ 9.95	per cy			
3" rock layer material unit cost =	$ 60.00	per cy			
3" rock layer cost =			$ 17.07	per lf	
Total ditch excavation and installation unit cost =			$ 22.49	per lf	

Notes:
a. Unit prices were taken mainly from RS Means Heavy Construction Cost Data 2019 (Means).

Abbrevia ions:
- cy = cubic yard
- bcy = bank cubic yard
- lcy = loose cubic yard
- ft = foot
- lf = linear foot
- ls = lump sum
- mo = month
- sf = square foot
- sy = square yard
- yr = year

Factors

Item	Factor	Source / Comments
Contractor overhead & profit	0%	Included in unit costs
Contingency, construction	20%	Appropriate for FS
Expansion/shrinkage between bank and loose state	1.1	Assume 10% for soil, sand, and gravel
South alignment ditch excavation	0.5	Assume 50% required excavation already met with existing ditch

GOLDER

golder.com